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INSTITUTE FOR DEFENSE ANALYSES

FY2000 End of Year Report: Volume III

Joint Advanced Warfighting Program

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U.S. Army and U.S. Marine Corps Interoperability: A Bottom-up Series of Experiments

Rick Lynch
Tom O'Leary

Tom Clemons
Doug Henderson

Preface

This report was prepared for the Director, Defense Research and Engineering, in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, under the task order Joint Advanced Warfighting Programs (JAWP). It addresses the task order objective of generating advanced joint operational concepts and joint experimentation to assist the Department of Defense in attaining the objectives of Joint Vision 2010.

Reviewers of this report include Dr. Theodore S. Gold, director, JAWP, and Colonel James H. Kurtz, USA (Ret.), Dr. Williamson Murray, and Mr. Joel B. Resnick, research staff members at the Institute for Defense Analyses (IDA).

The JAWP was established at IDA by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP Team is composed of military personnel on joint assignments from each Service as well as civilian analysts from IDA. The JAWP is located principally in Alexandria, Virginia, and includes an office in Norfolk, Virginia, that facilitates coordination with the United States Joint Forces Command.

This paper does not necessarily reflect the views of the Institute for Defense Analyses or the sponsors of the JAWP. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation. The JAWP fulfills its role by helping to elaborate new concepts and capabilities, conduct joint experiments, integrate related activities, and prepare for implementation. We expect our own views on these topics will continue to evolve.

Contents

1. Introduction

A series of joint experiments were conducted between December 1999 and September 2000 intended to facilitate Army and Marine interoperability and collaborative planning. The goal of this series of limited experiments was to build a Common Relevant Operational Picture (CROP) i.e. attempt to better define the common set of elements required by operational and tactical commanders. The experiments would include Army and Marine units already identified to participate in Joint Forces Command's Millennium Challenge experiment during August and September 2000. The command organizations for those units included the USMC Special Marine Air-Ground Task Force (Experimental) (SPMAGTF (X)), at Quantico, Virginia, and the 1st Brigade of the 4th Infantry Division (4ID), at FT Hood, Texas.

What follows is a brief overview of the project and some of the key observations and lessons learned from the interoperability experiments. Also included as an Appendix, is the After Action report drafted by Commander Tom Clemons, USN and Major Doug Henderson, USMC. These two officers, along with fellow JAWP officers, Lieutenant Colonel (P) Scott Schisser, USA and Major Kathy Echiveri, USAF, were key participants in the entire effort.

The motivation for initiating this effort was the realization that the Army and Marine Corps were both pursuing individual digital command and control experimentation, both organizations faced similar challenges, many of the lessons learned were similar, but there was no venue for these two Commanders and their organizations to share common experiences. In fact, the previous commanders of the Army and Marine Corps experimental units never met while in command. At a minimum, it seemed appropriate an introduction of the new commanders was in order. With that, a new JAWP project was set in motion. The objective of the project was to introduce the commanders and facilitate an exchange of lessons learned between the Army and the Marine Corps.

The effort kicked off with a visit to Quantico, Virginia, the home of the SPMAGTF(X). There the JAWP Team met Col Bob Schmidle, USMC, and observed some of the command and control experimentation activities that Schmidle was leading. Quickly following on the heels of the Quantico visit, the team, which now included Colonel Schmidle, visited Fort Hood, Texas, home of the Army's digitized experimentation effort. There the group met COL Randy Anderson, USA, and observed some of the command and control experimentation activities he was leading. Thus, the first series of visits and professional exchanges, had accomplished the first priority task. The current commanders of the Army and Marine Corps digital organizations had met, while still in command. But more importantly, they had established a relationship that would promote enhanced interoperability.

Collectively, this group saw motivated Soldiers and Marines doing similar things – only with different systems, save the Advanced Field Artillery Data System (AFATDS). What was immediately clear was that there was an opportunity to do more than just share lessons learned. There was a real opportunity to design a series of low cost, bottom-up experiments to enhance Army and Marine Corps interoperability via the creation and sharing of a Common Relevant Operational Picture (CROP).

Everyone involved in the effort realized that future warfighting, involving U.S. forces, would almost exclusively be joint and combined. Our joint doctrine is predicated on that foundation. There is a good possibility that a Marine Corps brigade size element will be fighting along side an Army brigade on tomorrow's battlefield—and that tomorrow might be literally tomorrow. They also realized that, if you were not interoperable, then frankly, you could not operate, at least not with any degree of efficiency and effectiveness. They also realized that something could be done now to improve joint warfighting effectiveness, i.e. improve our lethality and the same time improve the survivability of our Nation's most valuable resource- people. Waiting for technologists and engineers to build new widgets, have them tested, establish funding lines in the POM, and then wait five to seven years for procurement was not the preferred option. The question was, what could be done now, at the operator's level, to improve our ability to truly be interoperable?

There was also a common understanding that experimentation was not just about technology. What was learned over time was that once identified, problems in joint

warfighting need to be addressed by looking at potential changes in all the warfighting imperatives – Doctrine, Organizations, Training, Leader Development, Material, People, and Facilities. Too many times the default approach, buying new stuff - the "M" in DOTLMP, rather than truly investigating what the Services and joint organizations can do in the other areas. In this particular series of interoperability experiments, the experiments pursued a path that avoided looking at the "M" all together, and instead focused on the other imperatives. What could be done now to enhance interoperability between the Army and the Marine Corps, using existing equipment.

This was an essential point in the approach that was to be taken. A critical dimension that experimentation and innovation must always consider is the coevolution of the DOTMLPF imperatives. What do changes in one imperative, doctrine for example, have on the others such as organizations, leadership development, etc? It is almost impossible to make a substantive change in one area without causing a ripple effect of changes in the others. This necessitates a systems or coevolution approach, particularly in drawing conclusions from the lessons learned and insights gained. More importantly, big change is not likely unless DOTMLPF are coevolved as a coherent set.

The result was that the initial mission soon expanded to do more than just share lessons learned. The ad hoc team of Service and joint experimenters embarked on executing and creating a series of bottom up experiments, which leveraged and linked ongoing Army and Marine Corps Service experiments and training events. The Army Marine Corps Interoperability series of experiments were underway, but the team was not yet complete. Because of the JAWP's work with the new J-9 Joint Experimentation Directorate at Joint Forces Command, the group was aware of the J-9's work to plan coordinate and execute "Millennium Challenge 2000" in August and September 2000. J-9's Col Bill Meade, USMC, assisted by Mason Brooks of the JAWP, was leading that effort. And, one of Millennium Challenges major experimental objectives was creating a joint CROP. The fit was perfect, and the bottom up series of experiments envisioned could culminate as a portion of Joint Forces Command's "Millennium Challenge 2000".

Working at the operator level with the Army, the Marine Corps, and J-9, Joint Forces Command, the interoperability team developed and coordinated an enhanced series of interoperability experiments between the Army and the Marine Corps. First and foremost, the effort sought to define and establish a Common Relevant Operating

Picture for an upcoming major event- "Millennium Challenge 2000". Secondly, the effort attempted to improve collaborative planning tactics, techniques and procedures. Thirdly, the effort promoted the sharing of digital tools and lessons learned. And fourth, the effort enhanced the training of leaders and staff in a joint, digital simulation and live environment. The key element was that the effort did not aim at developing a new program, but simply tried to help users take advantage of what they already had.

Additionally, it was imperative to find ways to experiment using existing activities. These activities could be training events, live or simulated, already planned experiments, or demonstrations. None of the units and organizations involved needed to have anything added to already overflowing commitments. This necessitated using existing training and employment calendars as the hub for planning and scheduling.

The series of interoperability experiments evolved over four phases, beginning in December 1999, and culminating in September 2000. These phases took place in several locations, which included Virginia, California, Texas, New York, North Carolina, Louisiana, and Mississippi. The first phase focused on establishing initial connectivity between the Marines at Quantico and an Army Task Force working out of the Consolidated Technical Support Facility at Fort Hood. The second phase built on the initial connectivity established during phase one. The third phase had the Marines executing a live fire experiment at Twenty-Nine Palms, California, in coordination with Task Force working out of Fort Hood. And, the final phase supported Joint Forces Command's "Millennium Challenge 2000" and showcased the lessons learned in the previous three phases. In addition, the JAWP augmented a JTF headquarters cell, located at Fort Bragg, North Carolina.[1]

While "Millennium Challenge 2000" provided a common endpoint for the series of interoperability experiments, the true learning value of the effort lay in the journey and not just in successfully reaching the destination. Through each of the four phases, the ability of the Army and the Marine Corps to establish a CROP and do collaborative

[1] A more detailed description of the conduct of the series of experiments can be found in the After Action Report drafted by Commander Tom Clemons, USN and Major Doug Henderson, USMC which is provided in Appendix A.

planning improved. But of more importance, each phase provided insightful, and in some cases surprising, lessons. A few of the key insights and lessons learned follow.

2. Lessons Learned

2.1 No Effective Common Firewall Policy

The effort did not have to wait long before facing its first major stovepipe challenge. In attempting to pass electrons between the Army and the Marine Corps, without mutating or losing, "0s and 1s", the experimenters discovered that there was no joint firewall policy. Each Service had its own policy. The experimental units overcame the problem by each employing the same firewall protocols during the duration of each experimental event.

This issue would appear to be one that joint leadership can be fix with today's technology. Leaving it up to individual Services and joint activities to establish their own firewall policies fosters the continued stove piping of information. The fix is simple, there should be one effective DOD-wide policy that establishes what firewalls need to entail to safeguard networks, while promoting DOD-wide interoperability.

2.2 GCCS-A and GCCS-M As a Situational Awareness conDuit

The planned conduit for passing information was the Global Command and Control System. The planning assumption was that the Army version (GCCS-A) and the Marine Corps version (GCCS-M) would be fully interoperable. The good news is that GCCS does work as a conduit, but it required some tweaking. For example, the first Army unit location icons passed to the Marines were accurate in all regards save one, they appeared as red-enemy vice the correct blue-friendly.

2.3 Elements of a CROP Must Be Defined

Just passing masses of information is not useful. There is a set of information, when received in a timely and accurate manner, that significantly contributes to a task force

commander's higher, adjacent, subordinate, and supporting[2] situational awareness. Learning about what was useful and who needed it was a central objective. Over the course of the series of interoperability experiments, the essential elements of a CROP became much clearer.

In addition to the elements of a CROP becoming much clearer, the central role the commander plays in defining a CROP was also apparent. A commander brings to the battlefield a set of personally crafted and carefully articulated information requirements. The commander, as the decision maker, is the only one who can tell his staff, and his subordinate commanders, what he needs to know about his forces, about the enemy forces, and about his battlespace to make the right decisions at the appropriate time. The experiments made clear that it was essential that Army and Marine Corps commanders share their information requirements. Of keynote, these information requirements would not be the same, being different commanders; they focused on different things. But sharing the information requirements helped ensure that if a commander learned something that was critical to another commander, he could quickly and accurately share that information that information. The commander must always ask himself "What does the commander on my flank need to know?" – and then have an aggressive system in place to ensure that when his forces and intelligence assets acquire a piece of critical information, it is passed to his fellow commander immediately.

A key point in JV-2020 that was continually reinforced was that the critical factor was not information superiority, but rather decision superiority. How much information could be obtained was not a good metric. A much better metric was whether or not the right information got to the right commander at the right time so that commander could make decisive decisions.

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[2] "Higher, adjacent, subordinate and supporting" commanders/organizations is a common military way of describing with whom a commander needs to coordinate and share information. It connotes the commander/organization for whom he works, those commanders/organizations that work for him, those commanders/organizations that share boundaries with him, and those commanders/organizations that are in support of him.

2.4 Integrated Air Tracks Are a Critical Element of a CROP

A major shortcoming of this series of experiments was the limited air play. Even with this limitation, it became apparent that ground commanders need robust situational understanding of the air effort to synchronize their efforts with the joint task force commander's intent. Future interoperability experiments need to incorporate air tracks in the CROP. Whether this means importing the Single Integrated Air Picture (SIAP) or something less is not clear, but it certainly needs further exploration and experimentation.

2.5 Collaborative Planning Is Essential to Situational Understanding

The ability to share a common relevant operational common picture among higher, adjacent, subordinate, and supporting organizations provides vastly improved situational awareness. This capability is an important first step, but of greater importance is understanding how to use situational awareness at the operational and tactical levels. In other words, to exploit the full potential of a CROP, one must achieve situational understanding[3]. Situational understanding provides the ability for friendly units, joint or coalition, to synchronize operations and act decisively in concert based upon the emerging situation. During the Army and Marine Corps interoperability experiments, it became clear that, second only to understanding commander's intent, the key to achieving situational understanding was the ability to execute real time collaborative planning. Utilizing the Integrated Work Station (IWS) as a collaborative planning tool, Army and Marine Corps commanders could synchronize their operations. This included being able to work multiple simultaneous attacks and cross boundary fire missions.

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[3] It is important to understand the difference between situational awareness and situational understanding. Situational awareness is necessary but not sufficient. It simply implies that key individuals, regardless of where they are on the battlefield, are essentially looking at the same picture—they have the same awareness as to where the enemy is and where the friendly elements are. That is not enough. What is critical is that they all have the same "understanding" as to what the picture means. Given our situation, and the enemy situation—given our commander's intent—what does this mean? That understanding is reached by detailed collaboration between critical players. Then and only then can we achieve true situational dominance and decision superiority.

In exploring the bounds beyond simple situational awareness the experiments suggested that situational dominance equals situational awareness plus situational understanding. It was not enough to simply be able to answer the questions "(1) Where am I? (2) Where are my buddies? And (3) Where is the enemy?" To successfully exploit those answers, it was important that decision-makers not only had the same situational awareness, but also had the same understanding as to what they were seeing. Achieving this common situational understanding, made it possible to achieve situational dominance, i.e. fighting the enemy at terms and conditions that are to the joint force's advantage.

Key was that situational understanding was indeed a combat multiplier. The most powerful implication of situational understanding being that it gave adjacent commanders the ability to truly manage the tempo of the battle. This is not to say that it enabled them to fight faster or for the battle to be over sooner. In many situations, just the opposite was true. What situational understanding did was to allow the joint force to set and control the level of tempo and fight the enemy at the time and place of its choosing, on terms to its advantage.

2.6 Sufficient Bandwidth Remains a "Long Pole" in Providing Connectivity Between GCCS-A and GCCS-M

The question of the early 21st Century may well be how much bandwidth is enough. The Army and Marine Corps interoperability experiments found that bandwidth, like any other high demand - low density asset, needed to be prioritized and allocated. The interoperability series of experiments used a leased T-1 line (1.544 MBPS) as surrogate for a future wireless bridge. The experiments showed that the bandwidth provided by a dedicated T-1 line was sufficient for both GCCS traffic and the Integrated Work Station (IWS) collaborative planning tool.

It was also found during the course of the experiments that quite possibly, some of the bandwidth problem is a self-inflicted wound. Many enamored with technology believe that a VTC capability is essential for doing collaborative planning. They believe that it is important to see the person with whom they are talking, in real time. This requirement needlessly exasperates the bandwidth problem. An effective use of collaborative planning tool can eliminate the need for a VTC capability. During the interoperability experiments, as long as commanders and staffs were looking at a common picture (a snapshot of the battle at a particular point in time, centered at the same location, and in the same scale), were hearing each other's voices, and were able to see what the other was drawing on the map in real time, that was sufficient. There was no need see each other's faces and that saved significant bandwidth.

2.7 The Advanced Field Artillery Data System (AFATDS) Worked Well As a Direct Link Between an Army Tactical Operations Center (TOC) and a Marine Corps Combat Operations Center (COC)

Of the six Army and five Marine Corps systems used by the experimental units, only AFATDS was common to both. While the bad news is that the numerous different systems did not readily facilitate Army and Marine Corps interoperability, the good news was that AFATDS was a superb direct link. Army and Marine Corps forces executed direct, cross Service calls for fire. In Phase III, Army elements fighting in simulation at Fort Hood, observed an enemy target and then processed the call for fire over AFATDS that Marine Corps artillery battery in Twenty Nine Palms, California subsequently live-fired.

2.8 The Joint Duty Officers Whom the JAWP Made Available to the Army and Marine Corps Experimental Units Significantly Enhanced the Experiments and Expanded the Range of Interoperability Lessons Learned

The ad hoc team that came together grew from a small group of colonels to also include the active participation of additional JAWP civilian and military members. This provided an opportunity for Service experimental efforts, which had been principally Army green and Marine green respectively, to incorporate a joint perspective. A visitor to the Marines Combat Operations Center not only saw Marines and Sailors, but also a USAF Space Officer leading the ISR fusion center and a USA Aviator working as the Deputy MAGTF commander. Concurrently, a visitor to the Army Tactical Operations Center would not only see Soldiers and Airmen, but also a Marine logistician and a Navy Surface Warfare Officer actively engaged in Army operations.

This was significant in that the simple augmentation of each staff with other Service representation, from outside their Service, facilitated joint. The augments helped the respective commanders and staffs understand what the other Service was doing and why. And achieving that additional level of understanding markedly improved overall interoperability and effectiveness.

The true metric of success for any experiment is whether learning took place. On that criteria alone the Army and Marine Corps series of interoperability experiments were a success. But more importantly, the learning that took place was an expanded set of knowledge in that it linked Service and joint learning. And it did it at low cost and without negatively impacting ongoing Service experimentation efforts.

The key insights and lessons learned, some of which are described above, can help focus long term efforts of how the U.S. military can better fight as a future joint force. But the insights and lessons learned also have near term value in at least two areas. First, it provides a template of one way the Services can link their experiments and training event*s* in the future, in order to enhance not only the body of Service warfighting knowledge, but also the body of joint warfighting knowledge. Second, if the Army and the Marine Corps were committed to a Major Theater of War today, the lessons and insights gained in these experiments already provide a "leg up" for implementing and improving command and control interoperability procedures between Army and Marine Corps forces.

As a first step, it certainly appears that linking scheduled Army and Marine Corps experiments into a series of joint interoperability experiments was worthwhile. Expanding this idea would also seem to have merit. Leveraging and linking command and control experimentation activities across all four Services and the joint community could prove to be a low cost approach for designing and executing an expanded series of future interoperability experiments. Additionally, opportunities for greater and more continuous interoperability learning among the Services would be extremely useful. A good example would be leveraging the initial efforts for establishing a virtual training bridge between the Army's National Training center at Fort Irwin, and the Marine Corps' Air-Ground Combat Center at Twenty-Nine Palms. This effort, once successful, could then be expanded to include the Navy at Fallon, Nevada and the Air Force at Nellis, Nevada.

Working with the Army, the Marine Corps and Joint Forces Command on this low cost series of interoperability experiments was both educational and enjoyable for all of the JAWP participants. The experience was rich in learning and not only provided some insights about the critical elements of a CROP, but also provided insights about ways to link and leverage ongoing Service and joint experimentation efforts. The JAWP looks

forward to future opportunities for supporting similar hands-on concept development and experimentation with the Services and joint organizations.

Appendix A.
US Army and US Marine Corps Interoperability Experiment: Creating a Common Relevant Operating Picture - After Action Report

A.1 Summary

Achieving rapid decisive operations through full spectrum dominance against a future adversary requires coordination of joint effort among the service components. This coordination is gained through a situational understanding that results from a common picture and the ability to collaborate on intent. This decision superiority the Joint Force Commander seeks requires an interdependence of service systems that goes beyond interoperability. Interdependence includes interoperability (connectivity and compatibility of data), and common tactics, techniques, and procedures (TTPs), as well as common concepts of operations (CONOPS). Collaborative planning between commanders provides the common understanding of the shared picture that leads to decision superiority.

Yet, even the sharing of digital tactical picture between services traditionally has been difficult. Each service uses its own digital message format with different computer systems and they have yet to define the individual elements of a common picture as required by the unit commanders and the Joint Force Commander. As warfighting missions and execution across strategic, operational, and tactical levels blur, a common picture becomes the bridge to information superiority required by all forces at all levels. The picture of the battlespace required by a commander, however, differs between the theater CINC at the strategic level and the tactical commander at the operational level. Moreover, the requirements of the picture depend upon the functions performed by each unit and sometimes within units. Therefore, a common operational or tactical picture is not enough. To solve this scaling problem US Joint Forces Command has proposed establishment of the Common Relevant Operational Picture, a picture tailorable to the needs of the user. The operational level of command requires both tactically timely information as well as strategic planning and coordination capabilities.

This paper presents the results of a series of experiments conducted by the Joint Advanced Warfighting Program (JAWP) between December 1999 and September 2000 to look into Army and Marine Corps interoperability and collaborative planning in order

to define the elements of the Common Relevant Operational Picture (CROP) required by operational and tactical commanders. To achieve the digital connectivity, the experiment established a digital data connection between an army brigade Tactical Operations Center (TOC) and a Marine Expeditionary Brigade (MEB) TOC through a higher level command (similar to a Joint Force Land Component Commander (JFLCC) or a Joint Force Commander (JFC)). Units involved with the experiment included the USMC Special Marine Air-Ground Task Force (Experimental) (SPMAGTF (X)), at Quantico, Virginia, and the 4th Infantry Division (4ID), at FT Hood, Texas.

A key objective of this experiment was to gain insight concerning which elements should make up the CROP. Providing the commander a CROP that displays accurate and timely information should prove to be a combat multiplier in the future and provide the key that helps unlock true joint operations. The experiment's results support the following:

- Friendly Unit Locations:
- Known Enemy Unit Locations:
- Fire Support/Close Air Assets Available:
- Combat Service Support Assets Available:
- Neutral/Noncombatant Personnel:

In addition to CROP elements, other areas of significance include collaborative planning tools that are important contributors to situational understanding and thus decision superiority. Future experiments must include the Air Force and Navy as well as provide more testing in joint call for fire and close air support and a more detailed look at the combat service support requirements.

The future holds the promise of decision superiority through increased situational understanding provided by a common relative operational picture and its components. Development of the sensors and command and control systems to process the information to populate the database is progressing; however, interoperability between service systems proceeds in fits and starts. Interoperable systems must provide the tactical and operational commanders with the information they need to fight effectively in a distributed battlefield. The elements of that picture identified in this series of

experiments are the basic requirements for the CROP to help commanders achieve situational understanding and decision superiority. It is clear, even at this early stage in the testing process, that collaborative planning tools are an important part of achieving situational understanding. Unless commanders can interact and coordinate plans, the intentions of service components will remain a point of confusion.

A.2 Introduction

May 2005…

After a few years of relative stability, the Balkan region has once again become a powder keg. After rebuilding his political power base, Slobodon Milosevic has organized another well-coordinated attack on neighboring Kosovo. A brigade-sized Serbian Army task force has deployed and is moving south along the main avenues of approach through Kosovo toward the Albanian border. This appears to be the lead element for heavier follow-on forces that are massing along Serbia's southern border and preparing to move south.

The Serbians completely routed the Kosovo Army during opening phases of the operation, inflicting over 60% casualties in their well-coordinated combined arms attacks on the Kosovo forces. Small groups of Kosovo forces continue to offer disorganized and ineffective resistance. Additionally, the Serbs have killed many civilian Kosovars trying to resist this latest incursion, while many others have fled to the southern part of the country where they have overwhelmed relief organizations.

The situation is also precarious for the US Army battalion that is the lead element of the Initial Brigade Combat Team (IBCT) that forms part of the Rapid Response Joint Task Force (JTF). The battalion deployed into Tirana, Albania, and then moved northeast in their light armored vehicles (LAVs) with the objective of establishing a blocking position in Kosovo along the main route into Albania. Currently, the Serbs have pinned down two companies along a narrow valley road. Serb anti-tank missiles and heavy machine gun fire have destroyed two LAVs and disabled three others. The companies have dismounted their soldiers into defensive positions around the vehicles. The Serbian forces have isolated the companies from further reinforcements by blocking the narrow approaches from the south, while a Serbian tank company is moving south to envelop and destroy the American forces.

The JTF commander's options are limited. The IBCT has not completed deployment, with only two battalions and no organic fire support assets present on the ground. The priority of airlift had to be shifted to bring additional support to Aviano air base for the Air Expeditionary Force, which has the mission of striking enemy forces massing in

Serbia and halting further movement into Kosovo. However, the Marine Expeditionary Brigade (MEB) has finished conducting reception operations with afloat pre-positioned assets at the Adriatic port of Durres, and Naval Air and Surface fires from the Carrier Battle Group are available for support. The MEB has one mechanized battalion and one V-22-based vertical maneuver battalion ready for combat operations with a supporting artillery battalion ready to deploy into firing positions.

After viewing the common relevant operational picture on the Global Command and Control System (GCCS) that shows real-time tracks for friendly and enemy forces, the JTF commander develops enough situational understanding to issue a FRAG order. He calls his component commanders for a crisis action planning session. The JTF commander uses the collaborative tool's virtual conference room and whiteboard capabilities to draw out his scheme of maneuver to relieve the besieged battalion. He explains his intent to the component commanders.

Within minutes, his subordinates begin to execute his plan. The Marine Expeditionary Brigade deploys both maneuver battalions, while its mechanized battalion moves up from the south to destroy the enemy blocking force. The vertical maneuver battalion deploys into the steep passes in the north to engage Serbian mechanized battalion forces and to interdict the enemy's tank company. All parts of the force continue to track, in near real-time, friendly and enemy unit locations on a common tactical picture. The Marine artillery battery provides fire support against enemy force locations as the Army unmanned aerial vehicles (UAVs) operating overhead identifies them. When they discover an unidentified unit in the gap between Marine and Army locations, the two brigade commanders quickly coordinate their response through the use of the collaborative planning tools. Meanwhile, the carrier battle group in the Adriatic moves into position and begins supporting the Army battalion's fire support requests with carrier-based aircraft and anti-armor capable Extended Range Guided Munitions from an Aegis destroyer.

In just a few hours, US forces have destroyed most of the Serbian forces in place, while the remainder of the enemy has retreated in disarray to the north. As the situation stabilizes and US forces regroup for pursuit, the JTF commander thinks about the advantages that these tools provided his command. They have created an unprecedented level of situational understanding and decision superiority critical to realizing the potential of joint operations.

Achieving decision superiority required by the JTF commander in the above scenario depends on achieving a situational understanding of the battlespace. A central requirement in such situational understanding is the achievement of interdependence between units, both within a Service and jointly. Interdependence is more than interoperability, or the passing of digital information between systems to achieve situational awareness. Interdependence includes interoperability (connectivity and compatibility of data), and common tactics, techniques, and procedures (TTPs), as well as common concepts of operations (CONOPS). Yet, even the sharing of digital tactical pictures between Services traditionally has been difficult. Each Service uses its own digital message format with different computer systems. Admittedly, the Services have made some progress toward interoperability and collaboration in the area of air defense through multi-Service theater missile defense exercises and the "All Service Combat Identification Experiment Test," among others. In ground operations, however, the progress has been less dramatic. Due to system incompatibility, brigade-level Army and Marine forces cannot communicate a digital picture. A technical solution to this problem is forthcoming with the introduction of message translators, common interoperability between GCCS builds, and the promised Global Information Grid. Also, fortunately, the two Services have developed the TTPs and CONOPS associated with ground interoperability. However, the Services have yet to define the individual elements of a common picture as required by the unit commanders and the JTF commander.

A.3 The Common Relevant Operational Picture

This paper presents the results of a series of experiments conducted by the Joint Advanced Warfighting Program (JAWP) between December 1999 and September 2000 to look into Army and Marine Corps interoperability and collaborative planning in order to define the elements of the Common Relevant Operational Picture (CROP) required by operational and tactical commanders. The keys to gaining situational understanding and interdependence rest on a common picture and the ability to collaborate on intent. As warfighting missions and execution across strategic, operational, and tactical levels blur, a common picture becomes the bridge to information superiority required by all forces at all levels. Several efforts are underway to determine how to achieve such a picture. Unfortunately, these efforts remain uncoordinated, although several definitions exist. For instance, the Common Operational Picture (COP), as enabled by the Global Command and Control System (GCCS), differs among the Services and commanders-in-chief (CINCs), each using their own version of GCCS. The Chairman of the Joint Chiefs of Staff defines COP as follows:

… the integrated capability to receive, correlate, and display a Common Tactical Picture (CTP) including planning applications and theater generated overlays/projections (i.e., Meteorological and Oceanographic (METOC), battleplans, force position projections). Overlays and projections may include location of friendly, hostile, and neutral units, assets, and reference points. The COP may include information relevant to the tactical and strategic level of command.[1]

As defined in the same instruction, the CTP is:

> … derived from the Common Tactical Dataset (CTD) and other sources and refers to the current depiction of the battlespace for a single operation within a CINC's AOR including current, anticipated or projected, and planned disposition of hostile, neutral, and friendly forces as they pertain to U.S. and

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[1] Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3151.01, *Global Command and Control System Common Operational Picture Reporting Requirements*, 10 Jun 97, p. GL-3.

> multinational operations ranging from real-time and non-real-time sensor information, and amplifying information…[2]

These pictures, in somewhat simple form, are in use today. The Holy Grail of interoperability is one picture that shows everything to everyone. The picture of the battlespace required by a commander, however, differs between the theater CINC at the strategic level and the tactical commander at the operational level. Moreover, the requirements of the picture depend upon the functions performed by each unit and sometimes within units. Therefore, a common operational or tactical picture is not enough. To solve this scaling problem US Joint Forces Command has proposed establishment of the Common Relevant Operational Picture (CROP),defined as—

> …the presentation of timely, fused, accurate, assured, and relevant information that can be tailored to meet the requirements of the joint force commander and the joint force. It must be sufficiently robust and adaptable to accommodate exchange of information with non-Department of Defense (DOD) organizations (including Governmental, international, and private) and coalition forces. This presentation of information will need to be rapidly accessible by all approved users and must support the full range of military operations. The CROP is a key element of information superiority and battlespace awareness. The CROP is a derivation of what are currently referred to as Common Operational Pictures (COPs). Whereas COPs are unique to Commanders in Chief (CINC) and Services, CROP is envisioned as the single global operational picture for use by all joint forces. [3]

Each level of information in the common picture has different relevance depending on the commander's mission and priorities at each level. Consequently, it may be necessary to use all three pictures at the tactical, operational, and strategic levels of command. The tactical commander at the division/battlegroup/wing level and below requires near-real-time accuracy and timeliness to execute his missions. The CTP, based on tactical data links, provides this capability. The theater CINC, however, needs a broader view of the battlespace that includes logistics, deployment, and force capacity but not necessarily in as timely or accurate a fashion as the tactical commander. Therefore, the COP, based on the GCCS network, needs to provide the commander with the update rates and expanded data sets required for decision making at the strategic level. Finally, the subordinate JTF component commanders sit between these two extremes. This

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2 Ibid., p. GL-3.

3 US Joint Forces Command, *A White Paper for Common Relevant Operational Picture (CROP),* 22 August, 1999, p. 2-2.

operational level of command requires both tactically timely information as well as strategic planning and coordination capabilities. Here is where the CROP, a tailorable picture based on the commanders' needs, contributes to interdependence.

Therefore, every commander will have a unique set of display requirements managed through a hierarchy of importance and divided into the following categories:

- *Essential to the mission*. Information and displays that are critical for accomplishing the mission at each level.
- *Necessary to the mission*. Information required to achieve certain mission tasks and efforts. Key planning and overview information.
- *Additive to the mission*. Information that adds value to the mission by providing a significant combat advantage.
- *Enhances the mission*. Information not required for mission accomplishment, but which does improve planning and execution capabilities.
- *Extraneous to the mission*. Information of little or no value to mission accomplishment.

The Joint Common Tactical Database is the information bank that provides the information for the CROP. This data bank includes information from tactical, operational, and theater sensors; processed and analyzed intelligence; manual inputs from CROP managers; and inputs from reports generated automatically. Importing data and information from the theater COP also develops the database. The commander influences what data is relevant for his CROP by providing guidance on filter settings and overlays.

So, if as promised, the near future brings a common picture, the significant need to achieve interdependence becomes not how to share data, but how to share knowledge for joint decision superiority at each level? In other words, what are the elements of a common relevant operational picture, and how do commanders use that picture to collaborate and coordinate movement and effects? At present the Services are doing some work to define those elements for the JTF commander and his subordinates at the

operational level, but at the tactical level, they have done little to determine what data they need to exchange and how to use that data.

A.4 Army-Marine Interoperability Experiment

As stated earlier, the Joint Advanced Warfighting Program conducted a series of experiments between December 1999 and September 2000 to look into Army and Marine interoperability and collaborative planning in order to define the elements of the Common Relevant Operational Picture required by operational and tactical commanders. The goal of this series of limited experiments was to build a CROP that included Army and Marine units participating in Joint Forces Command's Millennium Challenge experiment during August and September 2000 with follow-on efforts to include the Navy and Air Force. Units involved with the experiment included the USMC Special Marine Air-Ground Task Force (Experimental) (SPMAGTF (X)), at Quantico, Virginia, and the 4th Infantry Division (4ID), at FT Hood, Texas. Table 1 shows the participants and location for various phases of the experiment.

Table A- 1. USA- USMC Interoperability Experiment Units and Locations

Phase	Dates	USMC Unit	Army Unit	Main Objective
I	15-17 Dec 99	SPMAGTF (X) Quantico, VA	TF JAWP CTSF FT Hood	Initial Connectivity
II	24-28 Jan 00	SPMAGTF (X) Quantico, VA	1BCT, 4ID CTSF FT Hood	Shared CROP
III	15-17 Mar 00	SPMAGTF (X) 29 Palms, CA	1 BCT, 4ID CTSF FT Hood	Call for Fire
IV	5 - 8 Sep 00	SPMAGTF (X) Camp Shelby, MS	1 BCT, 10th Mtn FT Polk, LA	Shared CROP Collaborative Planning

The experiment approached the problem with a crawl-walk-run philosophy with the first two phases focused on connectivity with more challenging objectives in the third phase. The Millennium Challenge '00 joint experiment sponsored by Joint Forces Command was going to include a continuation of this effort, but problems with fielding of software and hardware precluded the objectives planned for phase four. However, JAWP personnel did augment the JTF headquarters participating in Millennium Challenge and provided assistance with the CROP and collaborative planning initiatives.

The SPMAGTF developed the scenario for a live-fire training experiment at Marine Corps Base Twentynine Palms scheduled in March 2000. The scenario included a Marine Air-Ground Task Force (MAGTF) with future capabilities involved in making a ship to objective amphibious assault in conjunction with a digitized Army mechanized brigade already maneuvering in the operations area. The joint operations area for the experiment included the West Coast of southern California and extended inland to include the area surrounding the National Training Center at Fort Irwin and Twentynine Palms. The Army worked the Fort Irwin area, while the Marines operated in the vicinity of Twentynine Palms. This left a gap of approximately 75 km between Army and Marine units. Coordination and de-confliction of effort in this gap was the focus of the collaborative planning efforts. Other objectives of the experiment included:

- Sharing digital tools and lessons learned
- Enhancing training of leaders and staff in a joint, digital simulation and live environment
- Continuing on the path for improved interoperability.

A.5 Experiment Architecture

To achieve the digital connectivity, the experiment established a digital data connection between an Army brigade Tactical Operations Center (TOC) and a Marine expeditionary brigade (MEB) TOC through a higher-level command (similar to a Joint Force Land Component Commander (JFLCC) or a Joint Force Commander (JFC)). Figure 1 shows the operational architecture utilized for all three phases.

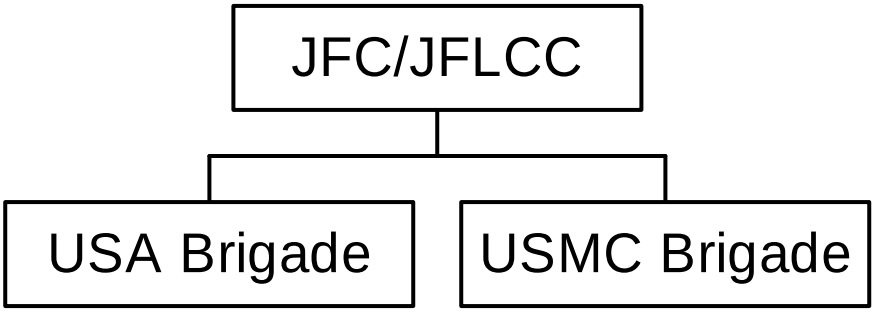

Figure A- 1. Enhanced Interoperability Experiment Operational Architecture

In phases I and II, the Marines utilized the Experimental Combat Operations Center (ECOC) located at the Marine Corps Warfighting Lab (MCWL) in Quantico as its command and control facility. The Army's Configurable TOC (CTOC) at the Central Test Support Facility (CTSF) in Fort Hood provided facilities to operate the Army brigade command center and JTF Headquarters. In phase III the Marine ECOC deployed to a field location in Twentynine Palms, California. A 128 Kbps ISDN line provided connectivity between operating locations.

Figure 2 illustrates the technical architecture. The experiment used fielded systems, or those with significant developmental progress. For command and control the Army used the Army Battle Command System (ABCS) in the CTOC. The Marine SPMAGTF (X) staff used the Integrated Multi-Agent Command and Control System (IMACCS) in the ECOC. Each Service's respective Global Command and Control System, (GCCS-A,

Army) and GCCS-M, (maritime), provided interoperability. Descriptions of the individual systems are in the appendix. The actual location of the various command and control systems differed from phase to phase in accordance with table 1.

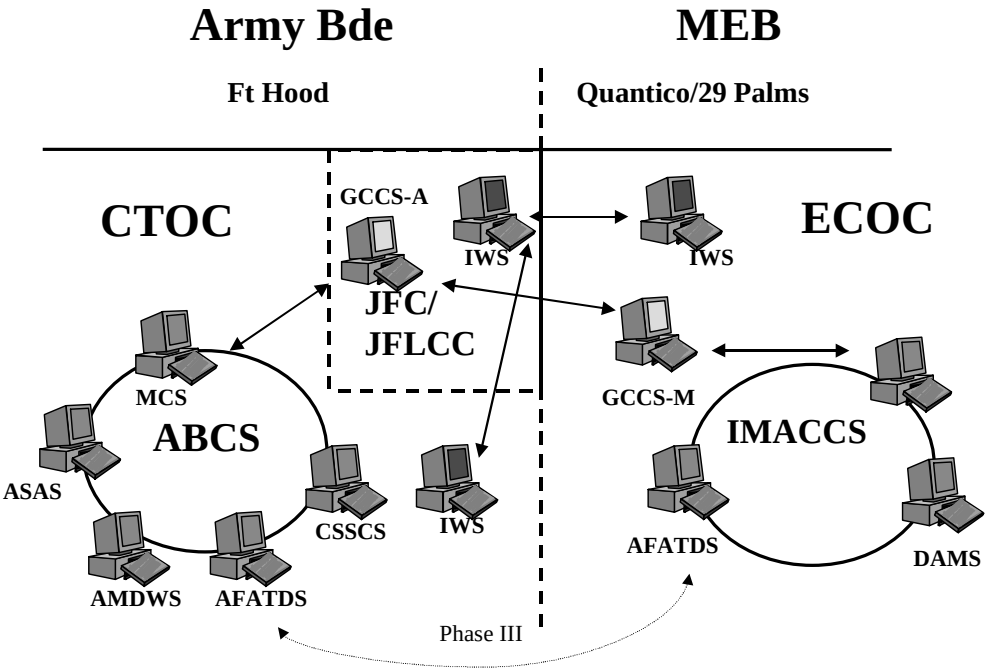

Figure A- 2. Technical Architecture

A separate personal-computer-based system provided collaborative planning capability between the participants via InfoWorkSpace (IWS) plug-ins to the Netscape browser. IWS is a server-based software system that uses Web browser capability to navigate through "meeting rooms" that provide chat, whiteboard, file sharing, email, voice, and video connections. IWS supports access by either preinstalled client software (a low-bandwidth version) or straight browser. IWS was available at workstations in the Army TOC, the JTF HQ, and in the ECOC as a collaborative planning tool for use by the JTF commander, the brigade commanders, and their staffs. While figure 2 shows workstations dedicated to IWS, any workstation with a Web browser was capable of joining collaborative sessions supported by one of the IWS servers.

At the Army brigade TOC in Fort Hood, the All Source Analysis System (ASAS) contained the enemy unit locations and the Maneuver Control System (MCS) held the

friendly picture. These systems, both part of the Army Battle Command System (ABCS), transmitted their pictures through GCCS-A to the GCCS-M at Quantico. A translator between GCCS-M and IMACCS allowed the Marine Corps staff to view the Army picture of the battlespace. The Marines used this same translator to move their tactical picture to GCCS-M and transmit the data through GCCS-A to the ABCS. In this way, both command centers had a view of the other Service's tactical picture. In addition, a direct connection between AFATDS systems existed during the third phase. This connection allowed direct transmission of targets between command centers and enabled an inter-Service request for fire support.

A.6 Experiment Results

Phases I and II were command post exercises (CPXs) with the SPMAGTF operating from their experimental COC at Quantico, Virginia. A team from the Joint Advanced Warfighting Program, along with soldiers who were proficient ABCS operators from the 2d Brigade, 4th ID, acted as an Army digital brigade headquarters and a higher headquarters (JTF/JFLCC) simultaneously from the C-TOC at Fort Hood, Texas. The goal of the first phase was to establish initial connectivity between the Army and Marine Corps through the GCCS systems and IWS collaborative planning system. A myriad of tasks had to be completed in preparation for phase I, including establishment of the communication network, familiarization training on IWS, the exchange of operations orders, and loading of digital map data and friendly and enemy orders of battle on the GCCS computers.

Phase I was only a partial success that offered as many problems as accomplishments. First, for network security reasons, the Network Operations Center at Quantico provided only a limited number of ports, none of which could support the bandwidth required by a fully developed CROP. This highlighted the absence of common OSD policy on information assurance and firewalls. Although the refresh rate was slow and tracks were not in real time, the experiment did realize a limited common picture. There were many problems with interoperability between the GCCS systems. Friendly and enemy force tracks changed identity, and duplications and erroneous icons were displayed at both ends. A member of the JTF team who simultaneously filled duties as CROP correlation manager, track manager, and network systems administrator worked this problem and made manual corrections as required. The IWS connectivity was also limited with collaboration only through the chat room and regular e-mail capability. As participants worked to overcome these problems, they collected valuable lessons that set the stage for a richer effort in the second phase.

The goals of the second phase were to solve the firewall problems that were never fully overcome during phase I, establish a CROP that displayed real- or near-real-time blue

force tracks, and conduct more collaborative planning using IWS tools. Phase II went well. The systems were able to send blue and red force tracks between the ABCS and IMMACS systems automatically and enabled expanded situational understanding. It was still necessary, however, to manage track correlation and fuse relevant information into the picture. Collaborative planning efforts showed the utility of the IWS and enabled the force commanders to synchronize operations while facilitating situational understanding.

During phase III the JAWP team at Fort Hood acted as the JTF and Army brigade command element, while the SPMAGTF deployed to Twentynine Palms for their limited objective experiment that included live-fire training. The primary goal of this phase was to enhance the CROP by displaying real-time red force tracks with blue force tracks and share the intelligence data generated by component ISR assets. Another goal was to establish a link over the Advanced Field Artillery Tactical Data System (AFATDS) and conduct a call for fire mission between the Services.

The phase III CROP displayed a clearer picture of blue and red force units and provided the acting JTF commander with unprecedented situational understanding of the operations area. With this common picture, the CJTF could make decisions that better integrated the operations of ground maneuver elements and applied force in a more effective manner. This common frame of reference also greatly enhanced the collaborative planning efforts as the IWS hosted meetings in virtual conference rooms that included audio links, video links, and electronic whiteboards. Also during phase III, Army and Marine Corps units coordinated an inter-Service live-fire support mission. A simulated UAV detected an enemy force in the gap between the Service areas of responsibility. The ASAS operator entered the target information and passed the data on to the AFATDS fire control system. The AFATDS operator generated a request for fire to suppress this new threat. This request was sent to the Marine ECOC at Twentynine Palms and down to a battery Fire Support Center that ordered a live-fire mission.

Even with these successes there were still problems in phase III. A newly released version of software for the ABCS system prevented automatic updates of the GCCS database from the MCS and ASAS. As a result, considerable effort continued on track management and correlation of displayed icons. This step backward in compatibility highlighted the frustrations encountered in pursuing a shared picture.

Phase IV objectives were focused on establishing a shared CROP and continuing to refine techniques and procedures associated with the InfoWorkSpace collaborative planning tool. The plan was to incorporate this initiative into the multiple efforts occurring under Joint Forces Command's Millennium Challenge '00 experiment. But due to difficulties of fielding additional hardware and software, the collaborative objectives between the participating Army and Marine units were never fully realized.

However, during Millennium Challenge, JAWP personnel involved in the interoperability experiments provided assistance with collaborative planning over IWS and the turnover of the CROP between the two JTF headquarters participating in the experiment. This turnover occurred between JTF XVIII (18th Airborne Corps) and JTF-2 (2d Fleet) as the scenario shifted from sea to ground operations. The issues and challenges that occurred during Millennium Challenge were very similar to those experienced during the previous phases of this effort.

A.7 Lessons Learned

A.7.1 CROP Elements

A key objective of this experiment was to gain insight concerning which elements should make up the CROP. Providing the commander a CROP that displays accurate and timely information should prove to be a combat multiplier in the future and the key to achieving true joint operations. The experiment's results support including the following information.

Friendly Unit Locations. The locations of friendly units in the battlespace are the most significant element for a common understanding of the situation. This element includes knowledge of the air defense umbrella, transiting aircraft, support centers, and locations of command centers and supporting forces.

Known Enemy Unit Locations: Second only to friendly locations, this element answers the final question of "where am I, where are my buddies, and where is the enemy." An indication of size, activity, and surveillance coverage of the enemy should form a portion of the description. This type of information helps unit commanders gain situational understanding needed to determine the best course of action.

Obstacles, Natural and Manmade. Maneuver is an operational imperative in the future joint force. All commanders on the land, sea, and in the air must know the location and coverage area of obstacles (such as terrain features, mines, barriers, AAA sites, and SAM sites), that limit or impede maneuver of the force.

Fire Support/Close Air Assets Available. The future force may consist of smaller and lighter forces, such as the Interim Brigade Combat Team (IBCT) deployed without organic artillery and fire support capability. Therefore, there will be a greater requirement to call upon other Services for fire support such as close air support (CAS) and naval surface fire support (NSFS). All commanders need to know locations of fire support and CAS assets in order to remain within the support range and, in the case of support providers,

to know where fires might be required. Information passed should include not only locations, but also coverage area and weapon status.

Combat Service Support Assets Available. As the Services move toward focused logistics and cross Service supply, knowledge of their location, make-up, and status will enhance the ability to identify and task service support from adjacent forces.

Neutral/Noncombatant Personnel. This is perhaps the most difficult of the CROP elements to provide and keep updated. In addition, there is a danger of this element overloading the capabilities of the CROP to update at a tactically significant rate. Yet, especially in complex and urban terrain, an inability to track neutrals and non-combatants may significantly delay and hamper operations.

A.7.2 Other Areas of Significance

In addition to CROP elements, several other areas are significant.

Collaborative Planning. Tools such as the capabilities provided by IWS are important contributors to situational understanding and thus decision superiority. Commanders must be able to collaborate on such issues as providing fire support, filling gaps in coverage, and establishing unity of effort. Chat room, voice, file transfer, and whiteboard capability are the absolute minimum tools required. Video does not usually provide the payoff for the cost in bandwidth. The collaborative planning needs to be an integral part of the tactical and operational systems such as GCCS and MCS, so that another computer workstation is not required.

Information Assurance. The lack of a common firewall policy among Services increases the difficulty in interconnecting. A common, DOD-wide policy could easily solve this self-inflicted impediment to interoperability. In addition, it is dangerous to use one policy for exercises and experiments and expect another policy during real-world contingencies.

Commonality of Systems. The ability to pass data directly between systems without having to rely on a translator, such as GCCS, greatly increases the speed and accuracy of the CROP. AFATDS, for example, increases the capability to interconnect between Services. Further development of message compatibility between MCS and IMACCS systems would better enable direct transfer of the tactical picture and would make it unnecessary to send data up through another level of command.

Web-based Interoperability. Web-based systems, such as InfoWorkSpace, allow for interoperability of digital operations without requiring the traditional engineering nightmare of "interoperability of digits." This is especially useful for disparate software systems that do not provide common data types. For example, a Web-based system allows captured weather data displayed at all workstations without the need to load similar software and send detailed data fields.

Doctrine. Future joint doctrine should better define the relevant information for a CROP in support of a Joint Force Commander and standard procedures to capture data from organic assets and echelons above and below. Perhaps one common picture for all levels of command is inappropriate. The CTP focuses near-real-time data for the tactical unit commanders, brigade and below. The CROP is appropriate for the JTF commander, his staff, and component commanders who need a tactical and operational picture of the battlespace, whereas the COP is the CINC-level picture providing strategic and operational oversight. Tactical systems such as AFATDS require near-real-time information in order to limit fratricide and give the commander confidence that the picture he sees is up-to-date. Furthermore, the tactical commander requires information that affects his operations. Providing him a complete picture of the theater battlespace will require additional bandwidth that may not be available on a rapidly moving battlefield. On the other hand, JTF and CINC-level commanders do not require such accurate and timely data and can rely on less frequent updates. They can thus save bandwidth for the greater amounts of data they must communicate.

Training. Training should focus across the levels of skill required to support the information technology that provides the CROP. This includes basic operators who operate the GCCS hardware and software, the track managers at all levels of command who conduct the critical correlation functions, and the database managers who ensure that the Common Tactical Database includes timely and relevant data. The CROP managers, working with systems administrators, must manage the entire CROP system and ensure that it provides the commander with a tool that adds value to the decision-making process.

Collaborative planning tools such as IWS are easy to learn and use and very beneficial. The personnel utilizing IWS during this experiment were able to learn enough of the IWS capability to conduct collaborative planning sessions in less than one hour of

training. As collaborative capability expands to other more common systems, this training requirement will continue to lessen.

Leader Development. Leader development must include current and future leaders in the advantages of a CROP. This training must include how a commander should shape a CROP based on different scenarios in the spectrum of conflict and his personal style of processing information and decision making.

Organizations. The future development of the CROP requires an examination into how adapting organizations might maximize this tool's potential. Potential examples include reorganizing staffs around information instead of functions, using technology with reach-back to reduce the core staff of a JTF and facilitate a more efficient decision cycle process, and adapting this capability to other areas, such as combat support and combat service support, to synchronize the tempo of operations.

Every commander should provide guidance to tailor the CROP based on his hierarchy of importance. From this commander's guidance, the CROP manager will have to continuously and aggressively manage both the tools that display the CROP and the information database that feeds the system. This management includes adjusting filter settings, correlating multiple sources of tracks, and fusing the information that will enhance the relevance of the display. In addition, the commander must develop standard operating procedures (SOPs) that delineate the format of collaborative planning sessions. During these sessions, participants must look at the same picture with the same scale, time hack, and filter settings or a common picture of the battlespace will not exist. This management is the key to the effective and efficient use of the CROP for enhancing situational understanding of the battlespace and decision superiority.

A.8 The Next Step

The series of experiments represented in this article constitutes the first step to defining the CROP and its impact on the tactical commander. Although the air picture and the passing of location data from Army field units through MCS using Force XXI Battle Command Brigade and Below (FBCB2) command and control system were both initial objectives, the experiment was unable to accomplish them. Future experiments must include not only Army and Marine testing, but also Air Force and Navy participation, more testing in joint call for fire and close air support, and a more detailed look at the combat service support requirements. The addition of Air Force and Navy participation in future experiments will enhance continued refinement of the elements of the CROP.

The US Army Training and Doctrine Command (TRADOC) and the Marine Corps Combat Development Center (MCCDC) are also pursuing better interoperability between MCS and the Tactical Combat Operations (TCO) systems. The two Services have signed a memorandum of agreement and an implementation plan to look into peer-to-peer interface between the MCS and TCO utilizing variable message format (VMF) messages. This effort will lay the groundwork for further development of TTPs and may lead to similar connectivity between other C2 systems.

A.9 Conclusion

The future holds the promise of decision superiority through increased situational understanding provided by a common relative operational picture and its components. Development of the sensors and command and control systems to process the information to populate the database is progressing; however, interoperability between Service systems proceeds in fits and starts. Interoperable systems must provide the tactical and operational commanders with the information they need to fight effectively in a distributed battlefield. The elements of that picture identified in this series of experiments are the basic requirements for the CROP to help commanders achieve situational understanding and decision superiority. It is clear, even at this early stage in the testing process, that collaborative planning tools are an important part of achieving situational understanding. Unless commanders can interact and coordinate plans, the intentions of Service components will remain a point of confusion.

Appendix B.
Command and Control Systems

B.1 Army Systems[1]

Army Battle Command System (ABCS)

ABCS is the integration of multiple battlefield operating systems (BOSs). The system is capable of automated interoperability between and with in the BOSs from the strategic through the tactical level. There are three components within ABCS- the Army Global Command and Control System (AGCCS), the Army Tactical Command and Control System (ATCCS), and the Force XXI Battle Command Brigade and Below (FBCB2) C2 system. The ABCS is tied to the joint environment through the GCCS. Each of the elements of ABCS are further broken down into subordinate systems.

B.1.1 Army Tactical Command and Control System (ATCCS)

ATCCS consists of the five Battlefield Functional Area systems: Fire Support- Advanced Field Artillery Tactical Data System (AFATDS), Intelligence- All Source Analysis System (ASAS), Combined Arms-Maneuver Control System (MCS), Air Defense- Air and Missile Defense Warfare System (AMDWS), Logistics-Combat Service Support Control System (CSSCS).

B.1.2 All Source Analysis System (ASAS)

ASAS is the intelligence electronic warfare sub-element of ABCS. ASAS provides combat leaders the asset management capability and the all-source intelligence needed to visualize the battlespace. ASAS provides all-source intelligence fusion to gives the warfighter timely and comprehensive understanding of enemy deployments, capabilities and potential courses of action.

Maneuver Control System (MCS)

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[1] Source: Army Green Book, AUSA, Oct 1999.

MCS provides Army tactical commanders and their staffs with automated, online, near-real time capability for planning, coordinating, monitoring and controlling tactical operations. It automates the creation and distribution of the common picture of the battlefield for the ABCS.

Advanced Field Artillery Tactical Data System (AFATDS)

AFATDS is a multi-Service (Army and Marine) digitized and integrated fire support battlefield management and decision support system. The system provides integrated, automated support for the planning, coordination, and control of all fire support assets, execution of counterfire interdiction and suppression of enemy targets.

B.1.3 Combat Service Support Control System (CSSCS)

CSSCS provides commanders and their staffs timely combat service support, situational understanding and force-projection information-data necessary to determine capability to support current operations and sustain future operations. The system rapidly collects, stores, analyzes, and disseminates critical logistics, medical, financial, and personnel information.

B.1.4 Air and Missile Defense Work Station (AMDWS)

The Air and Missile Defense Work Station (AMDWS), is an integrated system of weapons, sensors, and command and control elements that supports air defense weapons systems at the division-and-below levels. Integrating sensor inputs from various sources, AMDWS provides early warning, targeting, and control information to Forward Air Defense and supported units. An area-of-interest air picture is developed, and air tracks are identified using automated and manual means.

B.2 US Marine Corps Systems[2]

B.2.1 Integrated Multi-Agent Command and Control System (IMACCS)

IMACCS is a near-real-time decision-support application that coordinates the activities of multiple computer-based agents and human operators. It does this by integrating the digital network that consists of voice and digital messaging, SharedNet database information, and decision support software for all units in the MAGTF. The IMACCS object database integrates this data and all information-gathering assets throughout the battlespace to complete a decision-support tool for the ECOC.

B.2.2 Dynamic Airspace Management System (DAMS)

DAMS is a fire support deconfliction tool. It tracks friendly air and surface PLI, indirect fires, and effective kill and effective casualty radii. DAMS will alert the user to possible conflicts, such as aircraft passing through a gun-target line and impacts that could potentially cause friendly casualties.

[2] Source: X-File 3-35.3 'Battle Captain', MCWL, Quantico, VA

Acronyms and Abbreviations

ABCS	Army Battle Command System
ASAS	All Source Analysis System
AFATDS	Advanced Field Artillery Tactical Data System
BCT	Brigade Combat Team
CAS	Close Air Support
COP	Common Operational Picture
CONOPS	Concept of Operations
CPX	Command Post Exercise
CROP	Common Relevant Operational Picture
CTOC	Configurable Tactical Operations Center
CTP	Common Tactical Picture
CTSF	Central Test Support Facility
ECOC	Experimental Command Operations Center
FBCB2	Force XXI Battle Command Brigade and Below
GCCS	Global Command and Control System
IBCT	Interim Brigade Combat Team
IMACCS	Integrated Multi-Agent Command and Control System
ISDN	Integrated Services Digital Network
ISR	Intelligence, Surveillance, Reconnaissance
IWS	InfoWorkSpace
JAWP	Joint Advanced Warfighting Program
JFC	Joint Force Commander
JFLCC	Joint Force Land Component Commander
JTF	Joint Task Force
MCCDC	Marine Corps Combat Development Center

MCS	Maneuver Control System
MEB	Marine Expeditionary Brigade
NSFS	Naval Surface Fire Support
SPMAGTF (X)	Special Marine Air-Ground Task Force (Experimental)
TADIL	Tactical Data Link
TCO	Tactical Combat Operations
TRADOC	US Army Training and Doctrine Command
TTP	Tactics, Techniques, and Procedures
UAV	Unmanned Aerial Vehicle
VMF	Variable Message Format

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INSTITUTE FOR DEFENSE ANALYSES

Experimentation in the Period Between the Two World Wars: Lessons for the Twenty-First Century

Williamson Murray

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The Department of Defense (DoD) faces formidable challenges, intellectual as well as bureaucratic, in creating a joint experimentation program to help fulfill the ambitious goals of Joint Vision 2020 and related transformation objectives. Indeed, it is not an exaggeration to view experimentation as an unnatural act for DoD, particularly in a time of relative peace when our military success appears unchallenged. Therefore it is useful to look back at previous warfighting experimentation to see what may be relevant today.

Andy Marshall, DoD's Director of Net Assessment, has pointed to the period between the two World Wars as having special relevance, and has sponsored a body of work about military innovation in the 1920s and 1930s. A key feature of successful military innovation in that period was the attention paid to doctrine, organization, leader development, and training (i.e., the co-evolution of Doctrine, Organization, Training, Materiel, Leadership, and Personnel, or DOTMLP, in today's terminology).

America's recent experiences in the Cold War (in part, driven by the introduction of nuclear weaponry and intercontinental missiles) shaped attitudes and processes in DoD toward the view that technology is the overriding enabler of new military capabilities. But if the technologies of the Information Age are to provide revolutionary enhancements in military capabilities, we must step beyond a limited focus on materiel. Instead, as called for in Joint Vision 2020, we must seek to co-evolve new capabilities in multiple dimensions. Thus, we can learn from the experimentation efforts of U.S. and foreign military innovators in the 1920s and 1930s—perhaps more than from our own Cold War experience. In this paper, historian Williamson Murray draws on his own work, as well as upon the works of other leading military historians, to (1) provide a look at experimentation during this period, (2) highlight attributes of success, and (3) offer lessons for our own time.

Comments and questions are invited and should be directed to

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Preface

This report was prepared for the Director, Defense Research and Engineering, in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, under the task order Joint Advanced Warfighting Programs (JAWP). It addresses the task order objective of generating advanced joint operational concepts and joint experimentation to assist the Department of Defense in attaining the objectives of Joint Vision 2010.

Reviewers of this report include Dr. Theodore S. Gold, director of JAWP, and Mr. James H. Kurtz and Mr. Joel B. Resnick, research staff members at the Institute for Defense Analyses (IDA).

The JAWP was established at IDA by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP Team is composed of military personnel on joint assignments from each Service as well as civilian analysts from IDA. The JAWP is located principally in Alexandria, Virginia, and includes an office in Norfolk, Virginia, that facilitates coordination with the United States Joint Forces Command.

This paper does not necessarily reflect the views of the Institute for Defense Analyses or the sponsors of the JAWP. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation. The JAWP fulfills its role by helping to elaborate new concepts and capabilities, conduct joint experiments, integrate related activities, and prepare for implementation. We expect our own views on these topics will continue to evolve.

Contents

Introduction

At the dawn of a new century, the U.S. military services confront new challenges. Vast technological changes have already engulfed the society at large, and there is no sign that the pace of technological change will slow. Moreover, there are no real competitors on the horizon against whom the services can compare and evaluate their capabilities. In a nutshell, the United States does not know where, when, or against whom the next great test of its military forces will come.

Thus, it is difficult to judge issues such as readiness, force structure, logistical capabilities, and doctrine in a world of ambiguity and uncertainty, in which the full impact of technological change remains uncertain and military organizations will have to operate more jointly than ever before. The effectiveness of U.S. military power in the twenty-first century will depend on the interoperability and synergies among different sets of service capabilities. In other words, the integration of military power in joint campaigns will be essential at every level of war: the tactical, operational, and strategic.

How then will the American military achieve the battlefield effectiveness on which this country depends, and which will determine much of the strategic and political environment in the next century? Clearly, we are talking about a long-term transformation of military capabilities during an interwar period of indeterminate length. The last prolonged period of military transformation came in the 1920s and 1930s. The Director of Net Assessment in the Pentagon, Andrew Marshall, was among the first to believe that the world's military organizations are going through a similar period of change and that the U.S. military is only in the first stages in the creation of a possible revolution in military affairs.[1]

A number of issues emerge from a study of the period between the two World Wars in regards to transforming military organizations. These suggest important points that the American military need to consider in its efforts at transformation. In the 1920s and 1930s, the most important component in successful military innovation was the culture

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1 Andrew W. Marshall, "Some Thoughts on Military Revolutions," *Office of Net Assessment (OSD/NA)* Memorandum, 27 July 1993, p. 2.

of the military organizations that attempted to achieve major breakthroughs in their operational and tactical capabilities.[2] An important aspect of those cultures was the willingness to experiment with new concepts and ideas in annual maneuvers and exercises.

The purpose of this Joint Advanced Warfighting Program paper is to examine the process and philosophy of experimentation through which new operational concepts and capabilities were developed in the past, resulting in improved combat effectiveness. This examination should provide some help to senior military and civilian decision makers in thinking about how the U.S. military needs to go about experimentation in the joint arena in the twenty-first century—an area where much work remains to be done.

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[2] For the most thorough look at innovation in the interwar period see Williamson Murray and Allan R. Millett, eds., *Military Innovation in the Interwar Period* (Cambridge, 1996). See also Harold R. Winton and David R. Mets, *The Challenge of Change, Military Institutions and New Realities, 1918–1941* (Lincoln, NB, 2000).

The Elements of Innovation

There were a number of crucial elements in the process of successful experimentation during the interwar period. Before embarking on an examination of the actual record of experimentation in the 1920s and 1930s, we have established a list of those elements that contributed most to successful innovation during this period.

- Emphasis on the creative rather than on the evaluative measures of effectiveness as well as on the long haul rather than the short term.
- Experimentation as a part of a sustained campaign rather than a single event.
- Tolerance for surprise as well as failure.
- Consistent emphasis on red teaming to test fully concepts and emerging capabilities.
- Consistent emphasis on learning from past military experience through careful and thorough lessons-learned analysis.
- Finally, willingness to utilize and protect the forward thinkers in the organization throughout the process of experimentation and innovation.[3]

Where military organizations possessed the majority of these attributes, their experimentation process resulted in successful innovation; where they did not, experimentation floundered or resulted in fundamentally flawed innovations.

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3 This list of enablers for successful innovation has been shortened from the list in James H. Kurtz's *Joint Warfighting Experimentation: Ingredients for Success* to make the historical record more accessible and understandable. Kurtz lists the following enablers for joint experimentation over the coming decade: "Experiment in the proper context: 1) Focus on discovery and creation, not merely evaluation; 2) Learn from past experiments and experience; 3) Recognize 2010 and 2020 as azimuths, not destinations; 4) Integrate, leverage, and seek to influence service efforts; 5) Include international and interagency participation; 6) Protect the process…and the participants; 7) Provide for early immersion in the future; 8) Feature red teaming at every stage; 9) Treat experiments as extended campaigns, not one-time events; 10) Be tolerant of 'failure' and open to surprise. Use the results smartly; 11) Seek early success without sacrificing bold goals; 12) Be prepared to exploit success; 13) Involve stakeholders and provide persuasive results; 14) Aim at coevolution of doctrine, organization, training, materiel, leaders, people, and facilities." James H. Kurtz, *Joint Warfighting Experimentation: Ingredients for Success*, Institute for Defense Analyses, IDA Document D-2437 (Alexandria, VA).

The framework: intellectual creativity over the long haul

An emphasis on the creative

The opening sentences in the German Army's basic doctrinal manual of 1933, *Die Truppenführung*, underlined an emphasis on the creative over the evaluative in its approach to war as well as the preparations for combat:

> The conduct of war is an art, depending on free, creative activity, scientifically grounded.... The conduct of war is based on continuous development. New means of warfare call forth ever changing employment. Their use must be anticipated, [while] their influence must be correctly estimated and quickly utilized.[4]

Not surprisingly, a belief that experiments, exercises, and operations *must* emphasize the creative is at the heart of the German concept of war. In other words, the testing of concepts must allow maximum room for the participants to display their creative talents in order to understand the possibilities. This as much as any other single attribute separated the *Wehrmacht* from the other major armies of the period.

Experimentation as a campaign

Successful innovation in the interwar period also rested on a willingness or the necessity of taking a long-term perspective. Admittedly in the 1920s, military organizations possessed the luxury of time. For the Germans, the Versailles Treaty had reduced their army and navy to the point where serious military operations were not a possibility. During the Ruhr crisis of 1923, when the French occupied Germany's main industrial areas,[5] the *Reichswehr*'s leadership, particularly the army generals, advised the Weimar Republic's leaders that there was no prospect of successful military resistance to the French invasion.[6] Yet, the long perspective allowed the Germans to study the lessons of World War I in great detail and develop a combined-arms doctrine into which armored mobility even-

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4 *Die Truppenführung* (Berlin, 1933), paragraphs 1 and 2, U.S. War Department translation.

5 As a result of the failure of the German government to pay the reparations due to the French according to the Versailles peace settlement, the French Army invaded and occupied the Ruhr.

6 Walter Goerlitz, *History of the German General Staff, 1657-1945* (New York, 1962), p. 234.

tually fit with relatively little difficulty.[7] The result was the development of a set of devastating military capabilities that virtually destroyed the European balance of power in 1940.

The Germans were willing to embark on experiments with motorization well before any of the other European armies. The German efforts in this direction evolved over a lengthy period from the early 1920s to the late 1930s, but once they were clear on the issues—e.g., that panzer divisions were the way to go—they were willing to move ahead with great rapidity. At the time of the Czech crisis in September 1938 the *Wehrmacht* possessed only three panzer divisions. By September 1939, the *Wehrmacht* possessed six armored divisions, doubling the panzer force in a year; by May 1940, the *Wehrmacht* had ten; and by June 1941, twenty. In other words, careful experimentation over a sustained period eventually produced new capabilities—proven in battle—that the Germans then reinforced with the commitment of major resources.

Similarly, European, American, and Japanese military organizations that successfully innovated approached the problem of transformation as a long-term campaign rather than as a short-term effort to develop capabilities of immediate use. Carrier aviation in the U.S. Navy progressed in stages from spotting fires for the battle line, to providing long-range reconnaissance, to pulses of striking power that could damage the enemy's battle fleet before a fleet engagement took place, and eventually to striking power that could reach out on its own to wreck the enemy's fleet and land bases. By December 1941, the U.S. Navy possessed a carrier fleet that would revolutionize the conduct of war in the Pacific.

The initial thinking about the possibility of naval air power occurred before the First World War. By the early 1920s, the Naval War College was wargaming the potential of carriers even before the navy possessed a single carrier. These simulations indicated that carrier air power would do the most damage as pulses of air power.[8] Thus, when the fleet acquired its first carriers, U.S. naval innovators already possessed insights into the capa-

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7 See Williamson Murray, "Armored Warfare," in *Military Innovation in the Interwar Period*, chapter 1.

8 Thomas C. Hone, Norman Friedman, and Mark D. Mendales, *American and British Aircraft Development, 1919–1941* (Annapolis, MD, 1999), p. 34.

bilities they needed to develop. As a result, the naval officers created the landing and take-off procedures, the deck park, and the air tactics necessary to translate the capabilities of carrier-based airplanes into pulses of air power. Inextricably intertwined with this process of innovation were the fleet exercises and experiments that suggested further possibilities as well as new approaches.[9] Thus, the process of experimentation represented an extended campaign over decades rather than a single event.

The danger of over-emphasis on single events could not be clearer than the results of the British Army's experiments with armor in the late 1920s and early 1930s. The British never possessed a coherent framework—either conceptual or doctrinal—within which to cast their experiments with armor.[10] Thus, the army failed to learn from year to year as the experiments took place. Some smaller technological possibilities, such as the importance of radio communications, emerged and were not forgotten. But the larger possibilities, such as deep exploitation attacks, quite simply disappeared from the army's collective memory.

The results of the 1934 maneuvers serve to underline the dangers of an event-based approach to experimentation. In this exercise, the advocates of the tank—in particular B.H. Liddell Hart and J.F.C. Fuller—had raised the expectations of the observers, only to have those expectations dashed by an exercise format that aimed to train the soldiers and units rather than validate a concept. The result was that much of the army's leadership walked away from the experiment with the belief that the concept had failed and that the tank would not play a major role in the coming war.[11] Only the events in May 1940 eventually disabused the British Army's leadership of that view.[12]

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9 One might also note that the United States had begun working on the problems of underway replenishment as early as 1917 and continued in its fleet exercises throughout the interwar period to work on this capability, which was to prove a crucial enabler in the great fleet operations of 1944 and 1945. In this regard, see Fleet Admiral Chester W. Nimitz, "The Navy's Secret Weapon," *Surface Warfare* (reprint), March/April 1999.

10 For the best overall study of the British Army in the interwar period, see Brian Bond, *British Military Policy Between the Two World Wars* (Oxford, 1980). See also Williamson Murray, "British Military Effectiveness Between the Wars," in *Military Effectiveness*, vol. 2, ed. by Allan R. Millett and Williamson Murray (London, 1988).

11 The most thorough discussion of the conduct and result of the 1934 maneuvers is in Harold R. Winton's *To Change an Army, General Sir John Burnett-Stuart and British Armored Doctrine, 1927–1938* (Law-

There was also an additional issue with the 1934 armored experiment: those who designed the exercise presented the experimental armored force with a set of challenges that aimed to test the force's capabilities to the greatest extent possible, while extracting the maximum training from the effort—exactly what one should expect in terms of intelligent peacetime training. Fuller and Liddell Hart, who severely criticized the experiment's design, were unwilling to recognize that training must be an integral part of any program, including experimentation. Ironically, during this same period, although the Germans had no tanks (at least until their 1935 maneuvers), they were able to fold the lessons of tempo, speed, and the importance of coordination from the British experiments into their own conceptions of combined-arms, maneuver war.[13]

Testing concepts to the breaking point

Tolerance for surprise and failure

There is a larger point here. To be successful in the process of experimentation, military organization must be as willing to learn from "failure" as from success. That requires hard, rigorous testing on ranges and exercise grounds—a process that may result in as many failures as successes. And in the end, military organizations may learn as much, if not more, from experiments that fail as from those that succeed. The purpose of experiments should not be to prove a particular approach or concept "wrong." Crucial to an atmosphere conducive to successful experimentation must be an emphasis on creating the future rather than on grading current capabilities. True experimentation must possess a tolerance for failure; the 1934 British maneuvers appeared to fail.

However, the German "lessons learned" analysis of the 1934 British maneuver revealed that despite the apparent failure of the armored force, there were a number of positive lessons on the use of armor that suggested how best to extend armored warfare by an emphasis on combined arms. Moreover, the biggest gains in experimentation often came

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rence, KS, 1988), chapter 7. See also J.P. Harris, *Men, Ideas, and Tanks: British Military Thought and Armored Forces, 1903–1939* (Manchester, 1995).

12 See Winton, *To Change an Army*, chapter 7 on this point.

13 Williamson Murray, *The Change in the European Balance of Power, 1938-1939; The Path to Ruin* (Princeton, 1984), pp. 34-35.

from the unexpected. Thus, the emphasis throughout the German experimental process was on encouraging officers to pursue the creative possibilities.

Military organizations that attempted to control experiments invariably ended up limiting both the potential of technology as well as insights into the possibilities for future military capabilities. Here, the French Army offers a sobering example of how not to experiment.[14] French efforts in experimentation aimed to confirm existing doctrinal concepts and army preparations. The French military simply had no interest in challenging the senior leadership's decrees that had defined the "proper" method of force employment.

The French senior leadership made clear that it would brook no challenges. In the mid-1930s, General Maurice Gamelin, the army's commander-in-chief, banned any writings by his officers that were critical of the army's official positions. As the postwar general and military commentator, André Beufre, commented in his memoirs after the war, "Everyone got the message and a profound silence reigned until the awakening of 1940."[15] Thus, not only did French experimentation take place within a tightly scripted framework, but even within that controlled framework the French made little effort at stretching their forces.[16]

A consistent emphasis on red teaming

A substantial portion of the most success experimentation in the interwar period involved extensive red teaming. Here again the French came in last. They were simply unwilling to recognize that their future opponents, the Germans, might select another approach. The result was doubly disastrous. On one hand, they failed to test their own conceptions in a realistic environment. On the other, they ensured that French commanders facing the Germans in May 1940 had little understanding that the Germans might operate within a very different framework—one that emphasized speed, tempo,

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14 The two best books on the French Army's intellectual and tactical preparation for the coming war are Robert Doughty, *The Seeds of Disaster, The Development of French Army Doctrine, 1919-1939* (Hamden, CT, 1985); and Eugenia Kiesling, *Arming Against Hitler* (Lawrence, KS, 1997).

15 André Beufre, *1940, The Fall of France* (New York, 1968), p. 43.

16 See Kiesling, *Arming Against Hitler*, chapters 3 and 4.

and drive to a degree that French doctrine could not accommodate.[17] As the great French historian Mark Bloch, a staff officer during the campaign, noted in the late summer after the disaster:

> Our leaders, or those who acted for them, were incapable of thinking in terms of a *new* war.... The ruling idea of the Germans in the conduct of this war was speed. We, on the other hand, did our thinking in terms of yesterday or the day before. Worse still: faced by the undisputed evidence of Germany's new tactics, we ignored, or wholly failed to understand, the quickened rhythm of the times.... Our own rate of progress was too slow and our minds too inelastic for us ever to admit the possibility that the enemy might move with the speed which he actually achieved.[18]

Military organizations that posited an effective and well-trained opposing force capable of acting as an independent agent were invariably more successful at innovation than those that did not. Virtually all of the major American fleet exercises involved problems of fleet-on-fleet engagements. In these experiments, the presence of an opposing fleet created the opportunity to evaluate realistically the improving capabilities of aircraft and carriers. In a U.S. Navy fleet exercise in the early thirties, one side launched an air attack that caught and destroyed the opposing fleet in Pearl Harbor. In a tactical and operational sense, the Navy steadily gained new insights into the evolving possibilities of carrier aviation—an operational understanding that proved its worth in the naval combat that unfolded after the destruction of the battle fleet in December 1941.

Not surprisingly, the Germans were also quite good at involving red forces in the experimental process. In the case of armored development, their evaluations of the British Army's 1934 maneuvers suggested that all-armored forces could run into substantial difficulties on the modern battlefield. Thus, they pushed the development of the panzer divisions down a combined-arms path. It was the honesty of the red-teaming effort that made possible the crucial insight that the new armored force in the German Army's

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17 For a summation of the evidence of the impact of the French preparations for war on the 1940 campaign, see Williamson Murray and Allan R. Millett, *A War To Be Won, Fighting World War II* (Cambridge, MA, 2000), pp. 66–76.

18 Marc Bloch, *Strange Defeat* (New York, 1968), pp. 36-37, 45.

buildup should come within a combined-arms framework—rather than in terms of the all-armor formations that tank advocates like B.H. Liddell Hart and J.F.C. Fuller were touting in Britain.[19]

Learning from the past: the culture of experimentation

A consistent emphasis on learning from the past and the present

By pushing the envelope on concept development in experiments, military organizations can open the way to an understanding of the possibilities of future battlefields. Here military culture is essential to the process of successful experimentation. The Germans executed a major change in their military culture under General Hans von Seeckt in the early 1920s that placed the values of the general staff at the heart of the "German way of war."[20] The initial result was that they studied the actual lessons of the First World War's battlefields in great detail.

In the early 1920s, Seeckt established no less than fifty-seven different committees to study those lessons. As he noted to his subordinates: "It is absolutely necessary to put the experience of the war in a broad light and collect that experience while the impressions won on the battlefield are still fresh and a major proportion of the experienced officers are still in leading positions."[21] The *Reichswehr*'s leadership then ensured that its commanders and staff incorporated those lessons into an honest, realistic doctrine their officers and NCOs understood and practiced. Unlike the French, the Germans treated doctrine as a vehicle they could modify and expand in accordance with technological advances and as experiments suggested new possibilities.

This doctrinal framework was codified in a 1932 rewrite of the *Reichswehr*'s basic doctrinal manual, *Die Truppenführung*, by three of the army's senior generals (one, Werner von

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19 For all the immense interest focused on the German military in the interwar period, there has been very little written about the conduct of German military exercises throughout the period. Nevertheless, the comments of external observers as well as the documents underline a ruthless system of free play aimed at testing and refining doctrine and concepts. It was only after the outstanding performance of the test panzer regiments in the summer 1935 maneuvers that the German Army decided to establish the first three panzer divisions.

20 Here James S. Corum, *The Roots of Blitzkrieg, Hans von Seeckt and German Military Reform* (Lawrence, KS, 1992) is particularly good.

21 Ibid., p. 37.

Fritsch, soon became the army's commander in chief; another, Ludwig Beck, its chief of staff). The manual formed the basis for the *Wehrmacht*'s tactical and operational skills on the battlefields of Europe and North Africa in the Second World War. It emphasized combined-arms warfare, decentralized operations, leadership, and rapid exploitation on the battlefield.[22] But only constant experimentation and exercise ensured that the army's commanders and units practiced what they preached. Experimentation was a learning process that sought to expand the envelope of German thinking and to define doctrinal concepts. As Seeckt suggested about an early experiment with motorization in the Harz mountains in 1922:

> I fully approve of the Harz exercise's conception and leadership, but there is still much that is not clear about the specific tactical use of motor vehicles. I therefore order that the following report be made available by all staffs and independent commands as a topic for lectures and [further] study. Troop commanders must see to it that experience in this area is widened by practical exercises.[23]

The Germans tied the results of experimentation directly into their school system as well as their doctrinal framework—as did the U.S. Navy in its development of carrier aviation. Experimentation, doctrinal development, and the refinement of tactical and operational concepts went hand in hand. On the other hand, the British Army allowed its experiments in armored war to remain outside of its force development and doctrinal processes. As a result, the British, even during the Second World War, were never able to gain a handle on how best mechanized warfare might function.[24] The experimental process short-circuited because it was in no fashion connected to the actual business of soldiering in the British Army.

In the end, the development of German combined-arms, mechanized warfare was a twenty-year process in which the army carefully evaluated the lessons of the past and

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22 *Die Truppenführung* (Berlin 1933).

23 Reichswehrministerium, Chef der Heeresleitung, Harzübung, 8.1.22, National Archives and Records Service (NARS), microfilm roll number T-79/65/000622.

24 For further discussion on this point, see Williamson Murray, "British Military Effectiveness in World War II," in *Military Effectiveness*, vol. 3.

then folded those lessons in with the current experiences of experiments and exercises. The experiments and exercises of 1935 and 1936 pointed the way toward including tanks in the *Wehrmacht*'s combined-arms doctrine and moving battlefield exploitation from the speed of infantry to that of motor vehicles. Throughout this period, the Germans, including the tank pioneers, remained ruthless critics of the performance of their forces. The aim was to push the possibilities, rather than to maintain the status quo—evolutionary change tied to realistic evaluations of past experiences.

With the Germans, the learning process of experimentation did not end with the coming of war. Instead, as with peacetime exercises and experiments, the Germans studied their combat experience with the same careful lesson-learned approach that they used in peacetime to extend the possibilities that tactics and technological change offered. Thus, in April 1940, immediately before the opening of the Western campaign, the *Wehrmacht* carried out a series of experiments to enable close air support (CAS) during mobile operations.[25] The tests suggested that with forward air controllers assigned directly to the armored spearheads, the Germans could bring CAS directly to the support of advancing panzer columns.

However, because the French campaign was so close to its launch date, the Germans decided not to implement the results of the experiment. But beginning in summer 1940, they finished working out the process of air support in a mobile environment, folding in the lessons learned from the April experiment with the combat experiences of the May-June 1940 fighting. The result was that when they invaded the Soviet Union in June 1941, the Germans possessed the first modern CAS system to support mobile operations.[26]

Finally, the Germans were willing to alter and improve their conceptions on the basis of ruthless experimentation. During the *Wehrmacht*'s initial buildup, they established a number of different tank formations: panzer divisions, light divisions for reconnaissance, motorized infantry divisions, and independent tank brigades for infantry support. But as

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25 Up to this point the *Wehrmacht* possessed only the most primitive means to identify and support ground forces from the air. For a discussion of the development of German close air support see Williamson Murray, "The *Luftwaffe* Experience, 1939–1941," in *Case Studies in the Development of Close Air Support*, ed. by Benjamin Franklin Cooling (Washington, DC, 1990), chapter 2.

26 Murray, "The *Luftwaffe* Experience," chapter 2.

experiments continued over the course of the buildup, they narrowed the focus of their efforts to create mechanized forces. The success of the initial three armored divisions was such that the *Wehrmacht* created an additional three armored divisions and did away with the independent armored brigades in summer 1938.

The 1939 campaign in Poland reinforced the experience gained by experiments and exercises. Thus, in October 1939, on the basis of combat experience in Poland, the army converted four light reconnaissance divisions into panzer divisions, the most famous of which, the 7th Panzer Division, Erwin Rommel would lead during the French campaign.[27] By using the experimental process the Germans exploited their doctrinal and developmental successes to the maximum and developed combat capabilities that came close to winning the war.

There is a crucial comparison to be made between the German Army and the Royal Air Force (RAF). Throughout the 1930s the RAF carried out a number of experiments and exercises with its bomber squadrons.[28] The results were almost uniformly suggestive that British technological capabilities for the RAF's bomber force were inadequate to support the strategic bombing of enemy industries and population centers, a strategy that was at the heart of the RAF's conceptions of war throughout the interwar period. In May 1938 the assistant chief of air staff admitted that

> it remains true ... that in the home defense exercise last year, bombing accuracy was very poor indeed. Investigation into this matter indicates that this was probably due very largely to failure to identify targets rather than to fatigue.[29]

Yet the considerable number of exercises and experiments that indicated serious deficiencies in the bomber forces had little impact on the RAF's Bomber Command's preparations for war. It would not be until August 1941 that the Butt report, a careful analysis

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27 For the most recent evaluation of Rommel's performance during that campaign, see Karl-Heinz Frieser, *Blitzkrieg-Legende* (Munich, 1995).

28 For the Royal Air Force during the interwar period, see John Terraine, *The Right of the Line, The Royal Air Force in the European War, 1939–1945* (London, 1985), Part I. See also Williamson Murray, "Strategic Bombing, The British, American, and German Experiences," in *Military Innovation in the Interwar Period*, chapter 3.

29 Public Records Office, AIR 2/2598, Air Ministry File #541137 (1938).

of mission photographs by individuals outside of the RAF, indicated that Bomber Command was hitting few of its targets even under the best of night-time conditions.[30] Only then did the RAF's leadership become interested in solving the technological and tactical problems that had been affecting its forces in experiments well before the war.

This pattern of dismissing past experience (including wartime) as of being of little utility was a hallmark of the RAF's approach throughout the interwar period. In fact, in 1924 the Air Staff went so far as to reject history explicitly as of being no use in thinking about future war.[31] The result was that the RAF's leaders entirely missed the two crucial lessons of air power employment in World War I:

- First, that air superiority was absolutely essential to the conduct of any of the basic missions of an air force, including strategic bombing.
- And second, that finding and hitting targets accurately was an extraordinarily difficult business in bad weather or at night.

The underlying lesson would seem to be that if military organizations are unwilling to evaluate their experiments and exercises honestly in peacetime, they will find it almost impossible to evaluate their experiences in combat effectively under the far more unforgiving conditions of war.

Protecting the innovators

Finally, those military organizations that successfully innovated in the interwar period protected those who were responsible for the process of experiments and innovation. Successful experimentation and innovation required a command atmosphere that ensured that those who were thinking outside the box received suitable rewards from the promotion systems. Not only did military organizations, like the U.S. Navy, the U.S. Marine Corps, and the German Army, encourage innovators and experimenters, but partici-

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30 Sir Charles Webster and Noble Frankland, *The Strategic Bombing Offensive Against Germany*, vol. 4, *Annexes and Appendices* (London, 1962), appendix 13, p. 205.

31 Public Record Office, Air 20/40, Air Staff Memorandum 13A, March 1924.

pation in the process of experimentation was in many cases career enhancing.[32] In the case of the development of carrier aviation, the Congress of the United States[33] stepped into the Navy's promotion process in the mid-1920s, and by legislation ordered that command of carriers go only to those who had earned their wings as aviators.[34]

In the case of the Germans, Heinz Guderian, one of the leading figures in the development of the panzer arm, held a justifiable reputation not only for the ferociousness with which he advocated innovation with armored warfare, but for his rudeness to his superiors. At one point during an exercise/experiment with the panzer forces, the future Field Marshal Gerd von Rundstedt was reduced to commenting: " *Alles Unsinn, Alles Unsinn, meine lieber Guderian* (all nonsense, all nonsense, my dear Guderian)."[35] Yet the *Wehrmacht* tolerated Guderian throughout the 1920s and 1930s, and by the 1941 invasion of the Soviet Union, he was not only a full general, but commander of a Panzer Army. Guderian was not the only maverick in the German Army who advocated the concept of armored, maneuver war; there were a number of other irascible and enthusiastic innovators that the German military tolerated throughout the interwar period.

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32 For the U.S. Marine Corps in the interwar period, see particularly Allan R. Millett, "Amphibious Warfare," in Military Innovation in the Interwar Period, chapter 2.

33 This was done at the urging of the Morrow Board, which was established to examine the larger questions of military aviation.

34 Hone et al., *American and British Aircraft Carrier Development, 1919–1941*, p. 40.

35 M. Plettenburg, *Guderian: Hintergründe des deutschen Schicksals, 1918–1945* (Düsseldorf, 1950), p. 14.

The Focus for Joint Experimentation over the Next Decade

What lessons might the U.S. military draw from the experiences of the last great interwar period in thinking about where to focus future joint experimentation?

Focus on big change over the long term

Successful innovation requires an experimental process that aims to create new capabilities and concepts rather than grade current ones. Change, no matter how dramatic, requires hard, relentless work over long periods of time. For those involved in change, such as German officers during the interwar period, change may appear evolutionary, but to those on the receiving end, such as British and French officers in 1940, the results will appear revolutionary.

The services and those charged with supporting the process of joint experimentation need to think in terms of the long haul—in other words, both in terms of campaigns (rather than events) and long-term changes (rather than quick fixes). Quite simply, the experimentation process is not reducible to a single event or short period. Continuity, an evolutionary process, and attention to detail have all been essential to the achievement of successful revolutions in military affairs in the past, and there is no reason to expect that future military innovation will be much different.[36]

Focus on identifying potentially important new operational concepts and enabling capabilities

The services and the joint community need a more coherent vision (than is currently available) of what kind of operational concepts (and capabilities) they will require in the future. And that vision needs a strong sense of the realities of war in the past as well as the present. The experimentation in naval aviation in the interwar period underlines the importance of identifying new operational concepts early in the experimentation process in order to understand the enabling capabilities that will be needed. Without the concept of "pulses of air power," the enabling capabilities such as arresting wires and deck parks

36 For a discussion of this and other issues see MacGregor Knox and Williamson Murray, *The Historical Parameters of Revolutions in Military Affairs* (forthcoming, Cambridge, spring 2001).

might never have been developed—as was the case with the Royal Navy during the same period.

Recognize that the future opponents of the United States have choices

Those charged with experimentation cannot lose sight of the fact that future U.S. opponents will use every ounce of their human computers (brains) to dissect U.S. weaknesses, play to their own strengths (including political), and disable or mitigate U.S. technological superiority. Nor should experimenters lose sight of the fact that, as Clausewitz underlined, war is a brutal business that involves the death of our own soldiers as well as those of the enemy. No matter how attractive new technologies and concepts may seem, American experimenters should not forget the Prussian theorist's dire warning:

> Kind-hearted people might of course think there was some ingenious way to disarm or defeat an enemy without too much bloodshed, and might imagine this is the true goal of the art of war. Pleasant as it sounds, it is a fallacy that must be exposed: war is such a dangerous business that the mistakes which come from kindness are the very worst.[37]

Thus, the experimentation process requires healthy opponents: red teams that possess the knowledge, imagination, and capabilities to attack putative blue forces in new and imaginative ways. Red teaming must underline and expose the weak points as well as the strengths of U.S. forces.[38]

Recognize that the purpose of experimentation is change

The aim of experimentation should not be to validate current doctrine and concepts, but rather to challenge them—and change them. Experimentation is not about reaching a new stasis. In war, as in life, there is no constant or end state: everything is in flux. Failures may be as revealing in the experimentation process as "success." And, in some ways,

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37 Carl von Clausewitz, *On War*, trans. and ed. by Michael Howard and Peter Paret (Princeton, 1975), p. 75.

38 The philosophy of the opposing force (OPFOR) at the National Training Center at Fort Irwin, California, underlines the approach that U.S. forces need to take towards red teaming.

failures may be more useful than successes because they can suggest weaknesses that exist for future U.S. opponents to attack.

Tie experimentation to the implementation process

Experimentation that remains locked inside of itself, with no connection to the actual day-to-day business of preparing military forces for future war, is, at best, useless—and, at worst, harmful. It may well mislead senior U.S. leaders into thinking that the United States possesses capabilities that in fact have not been implemented in the regular forces. In this sense, the relationship among the Naval War College during the 1920s and 1930s, the fleet exercise planners, and the exercises themselves should prove particularly useful for those charged with thinking about experimentation and innovation in coming decades.

Focus on jointness and coalition war in all experimentation

The American military confronts a far more complex problem than during the 1920s and 1930s: the conduct of true joint operations, not as a singular event, but on a consistent, day-in, day-out basis. This very complexity makes it that much more difficult for those on the outside who provide the resources (i.e., the civilians in charge in the Pentagon and particularly those in the Congress) to understand what the issues are and how best to help push the process of innovation along.

But beyond the difficulties involved in joint operations (and at times, at least from Washington, they appear to be almost insurmountable), for the foreseeable future the United States is going to operate its military forces as a part of a larger coalition. Thus, the challenge in joint experimentation will not just lie in the integration and influencing of service efforts, but in thinking through the problems associated with coalition warfare. This will require U.S. forces and their commanders to think through the problems associated with working with military organizations and non-governmental organizations that possess different technologies as well as considerably different cultures and doctrines (not to mention political goals and conceptions of war).[39]

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39 A series of U.S. Marine war games involving Allied participation over the past year have served to underline that cultural and doctrinal issues are easily as important as technological differences in combined operations.

Focus on protecting the innovators and experimenters

Finally, the U.S. military must focus more distinctly on the problem of protecting those who are engaged in experimentation and innovations in entirely new ways of doing business. In the interwar period in the U.S. Navy and the German Army, those on the leading edge of innovation and experimentation were protected and encouraged by the organizational culture—to the greater benefit of military effectiveness. But the experience of the French Army in that same period underlines the penalties involved when military institutions remain entirely within the box in their thinking and fail to protect those who are willing to advocate new ways of doing business or new technologies.

JAWP

Institute for Defense Analyses

Joint Warfighting Experimentation: Ingredients for Success

Draft Final

September 2000

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September XX, 2000

The Joint Advanced Warfighting Program (JAWP) was established at IDA in April 1998 to be a catalyst for the transformation of US military capabilities, with particular emphasis on joint concept development and experimentation. We began our work by reviewing prior military experimentation efforts, surveying ongoing activities (primarily of the Services), and examining the tools available. From these early efforts we developed a set of ideas about what would constitute an effective program of experimentation. These ideas were honed over several months in discussions among the JAWP staff and in conversations with the US Joint Forces Command (formerly US Atlantic Command), other unified commands, the Joint Staff, the Services, and the Office of the Secretary of Defense.

At the same time, the JAWP began to develop exemplar operational concepts and to think through the joint experimentation required to learn how to make them work. One of these concepts, *Attack Operations Against Critical Mobile Targets*, was selected by the US Joint Forces Command to be the first joint experiment. At their request, the JAWP led the development of the concept and executed the associated experiment. The experience pushed our thinking about experimentation beyond the theoretical, and made it possible to generate a more thoughtful discussion of joint warfighting experimentation – what it is (and isn't), why it's needed, why it won't be easy, and how it can be done effectively.

There are alternative views on how to do joint experimentation. The view we espouse is of concept-based experimentation as a disciplined process of discovery, in which most of the real learning takes place in venues other than big field activities, and there is as much value from creative military people deducing "what might be" as there is in measuring what happened.

This paper does not necessarily reflect the views of the JAWP's sponsors. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation. We expect our own views on these topics will continue to evolve. Comments and questions are invited and should be directed to Joint Advanced Warfighting Program, ATTN: Jim Kurtz, 1801 North Beauregard Street, Alexandria, VA 22311-1772, telephone (703) 578-2836, FAX (703) 845-6810, E-mail jkurtz@ida.org.

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PREFACE

This paper, one of a series prepared by the Joint Advanced Warfighting Program (JAWP) at the Institute for Defense Analyses, explores joint warfighting experimentation. It outlines what experimentation is, why it is vital to the transformation of US military capabilities, and why it won't be easy. It next offers a recipe for effective experimentation – a set of ingredients essential for the systematic exploration of new military capabilities. It then briefly describes the first joint experiment, conducted by the JAWP under the auspices of US Joint Forces Command, and assesses how well that experiment incorporated these ingredients.

The paper is based in part on presentations given by members of the JAWP to various audiences. It also draws from the draft final report of the *Attack Operations Against Critical Mobile Targets* experiment, prepared by a team led by MG (Ret) Larry Budge, USA; and papers written by Dr. Robert Worley of IDA and Col Jack Jackson, USAF, of the JAWP. Other JAWP contributors include COL (Ret) John Fricas, USA; Dr. Bill Hurley; Lt Col Gwen Linde, USAF; COL (Ret) Karl Lowe, USA; Dr. Wick Murray; Col Tom O'Leary, USMC; Mr. Joel Resnick; LTC Scott Schisser, USA; and COL (Ret) Mike Starry, USA. Principal author-editor was COL (Ret) Jim Kurtz, USA.

The JAWP was established at IDA by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP Team is composed of military personnel on joint assignments from each Service as well as civilian analysts from IDA. The JAWP is located principally in Alexandria, Virginia, and includes an office in Norfolk, Virginia, that facilitates coordination with the United States Joint Forces Command.

This paper does not necessarily reflect the views of the Institute for Defense Analyses or the sponsors of the JAWP. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation. The JAWP fulfills its role by helping to elaborate new concepts and capabilities, conduct joint experiments, integrate related activities, and prepare for implementation. We expect our own views on these topics will continue to evolve.

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SUMMARY

Warfighting experimentation is a process of discovery. It differs from other military activities, such as training exercises, tests, and demonstrations. It aims to explore new and innovative combinations of doctrine, organization, and materiel; assess their feasibility; evaluate their utility; determine their limits; and foster their co-evolution into new capabilities.

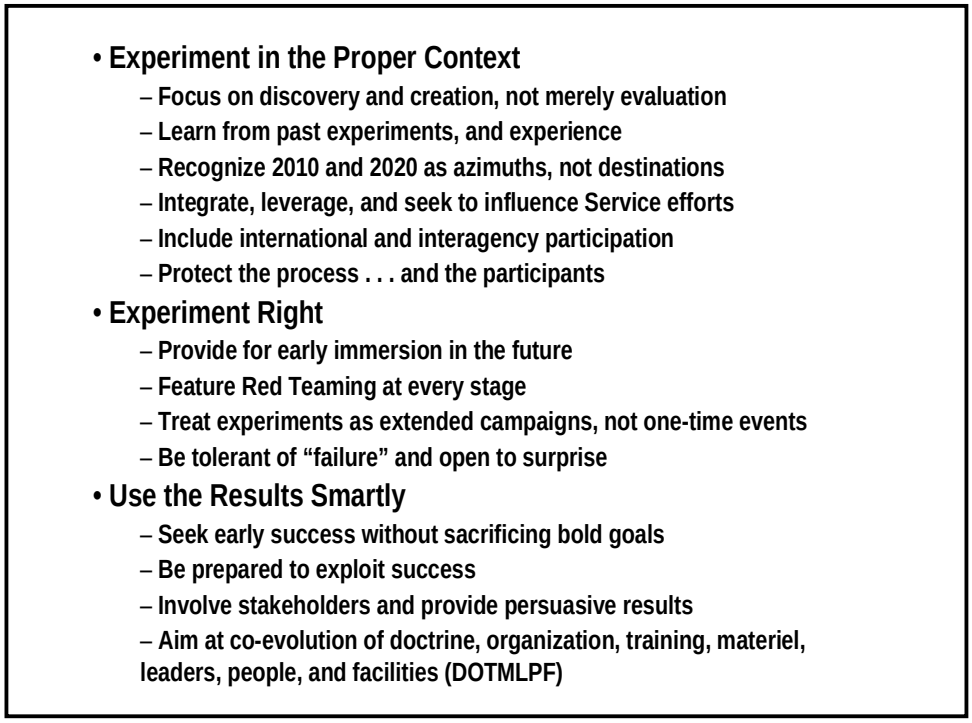
While the Services experiment routinely as they upgrade the capabilities they provide to the joint force, there is also a direct need for joint experimentation aimed at the operational level of war. Recent experience suggests that the demands placed on joint force commanders – integrating air, land, sea, and space capabilities to successfully execute military operations – will be even greater in the 21st Century. A variety of new threats and potential combat environments confound attempts to codify future requirements. An effective program of joint experimentation can help by exploring the alternatives and defining new pathways to more effective joint capabilities. It offers insurance against surprise and provides the means by which hard lessons can be learned and acted upon before US forces once again find themselves in combat.

Joint warfighting experimentation won't be easy, particularly if its objective is transformation – which can be succinctly described as big change. Change in large organizations is always difficult. It requires resources that are almost always in demand for other purposes. It requires, too, an uncommon blend of creativity, discipline, and open-mindedness. Experimentation to develop and refine advanced warfighting concepts must account for complex situations, capable and cunning adversaries, and human performance under extreme stress. Success in future operations will come to the side that can deliver decisive effects against the opponent's critical capabilities in a time sequence that disrupts his ability to plan and react. Identifying and measuring the specific effects needed to assure success will be a real challenge in operations where information, speed, and distributed precision attacks – not the traditional mass, lethality, and broad offensive action – will make the difference.

In designating the Commander in Chief, US Joint Forces Command, as the Executive Agent for Joint Warfighting Experimentation, the Department of Defense (DoD) took a major step toward managing these challenges. By conducting a wide-ranging program of joint experimentation, US Joint Forces Command can help ensure

that future joint force commanders have the "born joint" capabilities they will need to integrate and employ to greatest effect the capabilities being developed by the Services.

An effective experimentation program directed toward transformation will display certain essential ingredients. Together, these may be viewed as a recipe for success.



A Recipe for Effective Joint Warfighting Experimentation

The first joint experiment, *Attack Operations Against Critical Mobile Targets,* incorporated several of these ingredients, including a concept-based iterative process, aggressive Red Teaming, and a tolerance for surprise. Other characteristics essential for transformation, including early and vigorous involvement of key stakeholders, remain to be incorporated in future experiments.

Joint Warfighting Experimentation: Ingredients for Success

A. WHAT WARFIGHTING EXPERIMENTATION IS (AND ISN'T)

Warfighting experimentation is a process of discovery about new military operational concepts and capabilities. It is the process of systematically exploring new and innovative combinations of doctrine, organization, training, materiel, leadership, people, and facilities (DOTMLPF) to assess their feasibility, evaluate their utility, determine their limits, and foster their co-evolution into fielded capabilities.

Experimentation differs from other military activities, such as training exercises, tests, and demonstrations.

- Training exercises focus on proficiency in executing current doctrine, using current organizations and equipment. They offer limited utility for exploring new concepts, organizations, and materiel.
- Tests focus on whether a system (some combination of hardware and software) works. Experimentation tests ideas, not things.
- Demonstrations focus on showcasing success to persuade skeptics and build consensus around a concept. Experimentation seeks outcomes (such as driving a concept to failure) that would be unacceptable in a demonstration.

B. WHY EXPERIMENTATION IS NEEDED, AND WHY SOME EXPERIMENTATION MUST BE JOINT

For most of the Cold War, DoD built a military force to deter America's principal adversary and reassure our allies. When the Soviet-Warsaw Pact threat disappeared, the focus of DoD force planning was lost. DoD was still struggling to understand what kind of force the US would need – and could afford – to fulfill its role in the world when the Chairman of the Joint Chiefs of Staff published his vision for building a force with dramatically improved capabilities.

With technological innovation and information superiority as key enablers, Joint Vision 2010 established "full spectrum dominance" as the goal, implying a force that can dominate the full range of potential threats from the outset of any contingency. Its successor document, Joint Vision 2020, extended the notion of innovation to include experimentation and the importance of exploring "changes in doctrine, organization,

training, materiel, leadership and education, personnel, and facilities as well as technology."[1]

The congressionally-mandated National Defense Panel noted that achieving the kinds of capabilities embodied by "full spectrum dominance" would entail transforming the armed forces into a very different kind of military. The Panel recommended greater emphasis on experimenting with a variety of military systems, operational concepts, and force structures, because "it is this combination of technology, emerging military systems, new concepts of operation and force restructuring that often produces the discontinuous leap in military effectiveness characteristic of revolutions in military affairs."[2]

The Secretary of Defense supported the National Defense Panel's thrust toward transformation to exploit a possible revolution in military affairs, and cited Service Battle Labs and Warfare Centers as examples of experimentation efforts under way.[3] A more recent Defense Science Board review of DoD's transformation efforts found activities involving advanced concept development and experimentation in all the Services – activities that seemed to be of high quality and that were considerably more substantive than found by studies conducted a few years earlier.[4]

Service-specific experimentation is indeed essential to ensure the continued evolution of core competencies in the forces provided to joint force commanders by the Army, Navy, Air Force, and Marine Corps. And while new technologies, particularly information technologies, are important to the realization of Service visions, it is humans – soldiers, sailors, airmen, and Marines – who will drive the outcome of engagements, battles, and campaigns. Discovering the limits and consequences of human performance should be an essential focus of all experimentation.

For example, the Defense Science Board and others have postulated that small, distributed ground elements – given reliable, broad-band communications, superb situation awareness, and access to remote fires – could exert as much battlespace influence as a much larger force and be more responsive, agile and adaptive.[5] Such a distributed force could have at its disposal all the "things" that have until now been the

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[1] *Joint Vision 2020*, p. 11.

[2] *Transforming Defense: National Security in the 21st Century*, Report of the National Defense Panel, December 1997, p. 57.

[3] Secretary of Defense letter to Committee Chairmen, 15 December 1997.

[4] *Report of the Defense Science Board Task Force on DoD Warfighting Transformation*, Office of the Under Secretary of Defense for Acquisition and Technology, September 1999.

[5] See, for example, the *Report of the Defense Science Board 1996 Summer Study Task Force on Tactics and Technology for 21st Century Military Superiority*, Office of the Secretary of Defense, October 1996.

reason for assembling large formations. But what should such a force look like? What kind of leader will it need, with what kind of skills? What are its vulnerabilities? Only systematic experimentation can explore such questions.

There is also a need for experimentation that is joint. Historically, DoD has not had a joint approach for determining capabilities and force structure. Each Service has developed its own doctrine, organizations, and materiel and trained its units, leaders, and people, according to its own warfighting concepts. There have been multi-Service concepts, but few analyses in support of a weapon system have been cast in the context of joint force capabilities.

As a result, joint commanders at the operational level have been challenged to integrate sets of Service capabilities in whose development their point of view was hardly represented. Too often, Service systems that need to be integrated into a joint "system of systems" cannot talk to one another. Information collected by one Service's sensors that would increase the effectiveness of another's shooters cannot be shared because technical interfaces and formats differ from Service to Service. Assuring interoperability can increase costs and delay the introduction of needed capabilities; thus, from a force provider's perspective, it can make sense to sacrifice interoperability in favor of reducing cost or shortening the development cycle. But from the perspective of the joint force commander, who must integrate and employ all the capabilities the Services provide to the joint force, it makes little sense, if any.

The interests of future air, land, sea, and space commanders are well represented in the DoD force development process by the four Services. In the past, however, the voice of future joint force commanders – who will have direct responsibility for integrating those same air, land, sea, and space capabilities – have had little influence in decisions that determined the effectiveness of joint forces.

What is more, recent operational experience suggests that the demands placed on joint force commanders to successfully execute military operations will be even greater in the coming decades. While the US and its allies have enjoyed considerable success, a candid review of operations reveals that the factors of information, time, distance, and tempo present new problems. Issues of strategic agility, command and control, theater missile defense, and control and distribution of fires all suggest the necessity for a systematic investigation of new joint warfighting possibilities.

Absent the defining crucible of the Cold War and Soviet military power against which to measure US military capabilities, we cannot be certain what combinations of

doctrine, organizations, and technologies will be important for operational success. A variety of new threats and potential combat environments confound attempts to codify future needs using a Cold War requirements system. An effective program of joint experimentation can help by exploring alternatives and defining pathways to new and more effective joint capabilities.

The Commander in Chief, US Joint Forces Command, has been given responsibility to represent joint force commanders of the future in developing concepts and capabilities.[6] By conducting a wide-ranging program of joint experimentation, US Joint Forces Command can help ensure that future joint force commanders get both the interoperability and the "born joint" capabilities they need to integrate and employ to greatest effect the capabilities being developed by the Services.

C. WHY JOINT WARFIGHTING EXPERIMENTATION WON'T BE EASY

Change in large, tradition-bound organizations is always difficult. A program of experimentation is an effort to institutionalize a process for change, which runs counter to the tendency of bureaucracies to ensure survival by sustaining the status quo. Experimentation that aims at big change – transformation – will inevitably stimulate resistance. Experimentation that does not serve to support or further advance existing programs will be viewed with suspicion and subject to much debate and criticism.

Systematic experimentation requires resources that are almost always in demand for other purposes. It requires, too, an uncommon blend of creativity, discipline, open-mindedness, and support from the top – but can be stifled by too much top-down direction.

Experimentation to develop and refine advanced warfighting concepts must account for complex situations, capable and cunning adversaries, and human performance under extreme stress. Without the Soviet yardstick to measure ourselves against, there is an absence of consensus among DoD components about what capabilities are needed most. Experimentation also requires appropriate tools, particularly modeling and simulation. Joint and Service visions of future operations have in common the need for precision and speed to dominate an information-rich battlespace. Success will more likely come to the side that can tailor the right response and deliver decisive effects against the opponent's critical capabilities in a time sequence that disrupts and confounds

[6] Department of Defense News Release 252-98, *U.S. Atlantic Command Designated Executive Agent for Joint Warfighting Experimentation*, May 21, 1998.

his ability to plan and react. Identifying and measuring the specific effects needed to assure success will be a real challenge in operations where information and distributed precision attacks – not the traditional mass, lethality, and broad offensive action – make the difference. Complex, dynamic, precision operations will be difficult to replicate credibly without new models and new confederations that enable real-time human-in-the-loop interaction with technologies and organizations.

In designating US Joint Forces Command as the Executive Agent for Joint Warfighting Experimentation, DoD took a major step toward overcoming these inherent challenges. But supporting organizations are immature at best, and truly joint processes and procedures have to be invented.

D. A RECIPE FOR EFFECTIVE EXPERIMENTATION

The following discussion assumes that joint warfighting experimentation has transformation as its primary objective. It should focus on learning about concepts that can lead to a breakthrough in the overall capability of joint forces. To help define the parameters of a joint experimentation program and keep it oriented on big change, the following are offered as ingredients essential for effective experimentation.

1. Experiment in the Proper Context

Focus on discovery and creation, not merely evaluation

The object of experimentation is innovation – tinkering with new ideas to discover those worth pursuing. Creative leaders, with a passion for ideas they believe in, are at the heart of successful innovation. Examples can be cited in every Service:

- Army officers Billy Mitchell, Henry H. Arnold, Carl Spaatz, Ira Eaker, and James H. Doolittle championed the idea of air power long before they dreamt of a United States Air Force.

- While still a junior officer, William S. Sims made such a nuisance of himself that the Navy finally adopted, against the judgment of many of its leaders, his continuous-aim firing methods. Years later, as President of the Naval War College, he pioneered the use of wargaming and joined other visionaries such as William Moffett, Joseph Reeves, and Jack Towers in pushing the Navy to experiment with aircraft carriers.

- Marine Corps Major Earl H. Ellis was the intellectual father of amphibious warfare, but it took the support of Commandant John H. Russell and the energy of true believers like Holland M. Smith to turn the concept into a fielded capability.

- Generals James Gavin, Hamilton Howze, Harry W.O. Kinnard, and others who saw clearly the potential of helicopters as a means to achieve tactical mobility drove the Army to experiment with, and ultimately embrace, the concept of air mobility.[7]

Creative leaders generally have gathered around themselves a team of enterprising individuals who share their belief in an idea and committed themselves to making it work. Admiral Moffett knew which officers shared his vision of naval aviation and influenced their assignments to create critical mass around the idea. General Kinnard, when told by the Army Chief of Staff to pick a few men to help determine how far and how fast the Army should go in embracing air mobility, knew exactly which few to pick. But assembling a team of creative people with a shared passion will be more difficult in the joint world, because the Services control assignments and career imperatives – skill progression, command, and professional military education – impact on the availability of people with the requisite talents.

Learn from past experiments, and experience

Transformation is at its root a process. It can be slow and methodical, or it can happen quickly: for example, the first combat use of air power occurred only 11 years after the Wright Brother's first flight. The process must be tailored to fit specific times and specific institutions, but valuable insight can be gained by studying prior efforts that brought about big change, as well as those that failed.

Much of the attention currently paid to past military innovation focuses on the years between World Wars I and II. More recent examples include the Army's air mobility experimentation and rebuilding effort after Vietnam; the Army-Air Force development of air-land battle doctrine, and the Navy's efforts to develop architectures that ultimately enabled implementation of the Cooperative Engagement Concept.

Today, all the Services are conducting experiments to develop and refine their future operational concepts. The lessons they learn in doing so are an ideal starting point for joint concept development and experimentation.

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[7] To learn more about these successful efforts at innovation, and others not so successful, see Elting E. Morison, *Men, Machines, and Modern Times,* The Massachusetts Institute of Technology Press, 1966; Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military,* Cornell University Press, 1991; *Military Innovation in the Interwar Period,* edited by Williamson Murray and Allan R. Millett, Cambridge University Press, 1996; General Hamilton H. Howze, Ret., "Army Aviation 1955-1962: The Foundation of Air Mobility" in *Army Aviation,* December 31, 1992, pp. 26-34; and Lieutenant General Harry W.O. Kinnard, Ret., "Army Aviation in 1963-1972: The 'Golden Age' Begins" in *Army Aviation,* December 31, 1992, pp. 36-46. For a study of prior military experimentation efforts, see Williamson Murray, *Experimentation in the Interwar Period: Lessons for the Twenty-First Century,* IDA Document D-2502.

Recognize 2010 and 2020 as azimuths, not destinations

An ancient proverb says, "When the wise man points at the moon, only a fool stares at his finger." JV 2010 pointed toward a military force able to dominate any situation in which it is committed. It is a goal, not the date by which the force is to be fielded. Some of the capabilities envisioned in JV 2010 and its successor documents may be achievable in a few years, others may be as distant as the moon.

Experimentation must be understood as a process for change, not a schedule . . . a journey, not a destination. The important thing is to start, and to learn along the way.

Integrate, leverage, and seek to influence Service efforts

Service participation is crucial to successful joint warfighting experimentation, not only to obtain the Services' buy-in, but also – and more importantly – to capitalize on their energy and resources. Joint experimentation that does not involve the Services risks becoming just one more "stovepipe."

The Services are the institutions that organize, train, and equip military forces. They have the experience, expertise, and resources to develop concepts and requirements to fulfill the roles assigned to them by Congress. They have the wherewithal to initiate and manage programs that develop and acquire new capabilities. Each Service looks at its portion of the battlespace and does its own concept development and experimentation to determine and develop the capabilities it thinks the joint force will need. A key objective of joint experimentation must be to influence and integrate future Service capabilities – to develop joint employment concepts that will allow the capability of the joint force as a whole to be greater than the sum of its Service parts.[8]

Include international and interagency participation

The National Security Strategy of the United States says that while we will not hesitate to act unilaterally where necessary, we prefer to act in concert with the international community whenever possible.[9]

A gap between American and allied military capabilities, highlighted in operations in Kosovo, remains a concern. As more sophisticated command-and-control and support capabilities emerge in the US armed forces, some gaps seem certain to widen. Experimentation to develop new military concepts and capabilities will have to

[8] For a framework that shows how Service and joint operational concepts can relate to and reinforce one another, collectively producing capabilities greater than the sum of their individual contributions, see Karl Lowe, *A Framework for Joint Experimentation – Transformation's Enabler*, IDA Document D-2280.

[9] *A National Security Strategy for a New Century*, The White House, December 1999.

explore roles that selected allies can reasonably be expected to play. Involving allies early in the concept development and experimentation process will help persuade them to take full advantage of experimental "discoveries" in transforming their own capabilities.

Protect the process . . . and the participants

Experiments are harbingers of change, and change is threatening. Innovative endeavors, and especially the innovative people that drive them, need uninterrupted support from the top. The process of innovation requires protection from bureaucratic reprisals, but not from criticism. Protection includes managing expectations – inside as well as outside the process – so that undue criticism does not flow from unreasonable fears or unrealistic expectations.

Admiral William Moffett, as head of the Navy's Bureau of Aeronautics, supported and protected naval aviation in its infancy. He secured legislation so that only aviation officers could command Naval Air Stations and aircraft carriers. He invited senior officers from the surface Navy to gain aviation wings as "observers" without having to go though the full training program for pilots. And he placed these observers in aviation commands, where they were eventually replaced by younger officers who had grown up in aviation.[10]

Providing cover and protection for those involved in developing and promoting advanced joint warfighting concepts will be a challenge in the joint world. Because promotions and assignments are controlled by their parent Services, officers may be understandably reluctant to champion joint concepts that do not conform to conventional Service wisdom.

2. Experiment Right

Provide for early immersion in the future

Thinking about the future is hard, but essential to innovation. To overcome the natural hesitancy to confront an uncertain future, we now have the ability to create a virtual environment, place innovative operators in the middle of it, and challenge them to discover what they can accomplish with new organizations; command-and-control arrangements; and tactics, techniques and procedures. Placing new technologies into such an operational context – letting real people play with simulated future systems – connects the operator to the technologist and links "concept push" to "technology pull."

[10] Rosen, *Winning the Next War*, pp. 76-79.

In creating such a future environment, it is necessary to make informed judgments about the performance of systems that do not yet exist. Then, given a range of performance, the objective is to determine how valuable such systems might be. This means asking operators to employ the future systems in different ways in a simulated battle or campaign, then letting the results drive development of the concept and, ultimately, of real systems.

Feature Red Teaming at every stage

Aggressive Red Teaming is key to ensuring that results of experimentation are robust and persuasive. Failure to expose a concept to Red Teaming can lead to adoption of a doctrine incapable of countering more forward-looking concepts that a potential enemy might develop. An example is the Maginot Line. Built at great cost during the 1930s to prevent the violation of French territory, the Maginot Line did well most of the things it was designed to do. But its designers failed to extend the defenses all the way to the English Channel, and instead relied on terrain (the Ardennes Forest) and allies (the Belgian Army) to protect the left flank and buy time for organizing French defenses. The designers never anticipated the fast-moving mechanized forces, dive-bombers, and Blitzkrieg tactics that, in the end, made the Maginot Line irrelevant. A "Red Team" – encouraged to challenge the effectiveness of the defensive chain when it was still in the design stage – could have uncovered its weaknesses.[11]

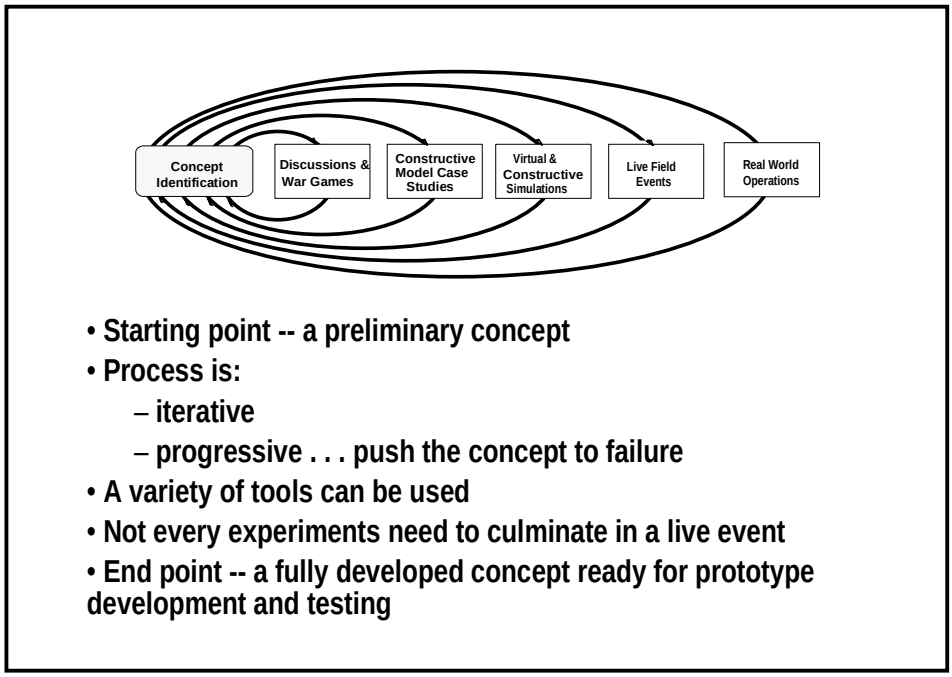
The US Navy's nuclear submarine force provides a model. Members of this community were given wide latitude to examine any number of counters to US nuclear submarine capabilities, and directed to report their findings directly to the Chief of Naval Operations without bureaucratic interference. The key is to pit a robust Blue Team against an innovative and aggressive Red Team, letting both sides learn and adapt as they go so that both sides help improve the effectiveness of the Blue concept.

Treat experiments as extended campaigns rather than one-time events

Experimentation aimed at discovery is by its very nature an iterative process. The first step in military experimentation is development of a concept – a new, integrated set of doctrine, organization, training, materiel, leadership, and personnel – intended to perform some function. Iterative trials within a single experiment may increase confidence that the results are not a one-time fluke and that the concept under consideration can be robust over a range of conditions. More importantly, iterative

[11] Rudolph Chelminski, "The Maginot Line," *Smithsonian*, June 1997, pp. 90-100.

experiments are essential, because the goal is to learn about the concept, and a single experiment is not likely to reveal all there is to learn. An experimentation campaign is therefore progressive in nature, with the results of one experiment informing and shaping the design of the next.



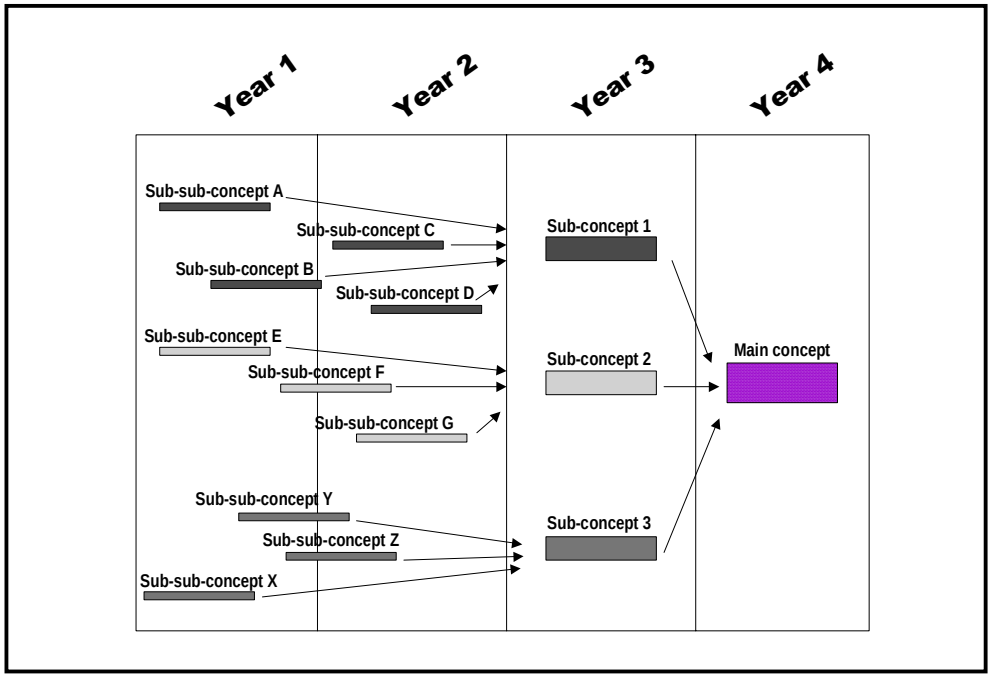
Concept Development and Experimentation

Some argue, for example, that, in the future, technology will allow distributed ground forces to mass effects without having to mass the large formations typical of past conflicts. Such a concept entails significant risks, and reason demands that implementation be preceded by confidence that we have the people; organizations; systems; connectivity; training; and tactics, techniques and procedures to do the job. Gaining the necessary degree of confidence could involve a progression of small and medium-sized experiments before putting them all together in some large event to see how well the overall concept works.

An example of a "small experiment" is one conducted at IDA's Simulation Center for the 1996 Defense Science Board Summer Study. Army and Marine Corps lieutenants and captains were assembled, given information sufficient to establish "situation awareness," formed into two-man teams, given a mission, and asked to formulate a plan, which they executed in an interactive simulation. At the end of each "run," changes were made based on the teams' recommendations. Two-man teams became three-man teams.

The information they were given changed, as did the way it was displayed. Such an event may be termed a "small experiment" – discovering what a team of junior officers can do, given certain technological advantages.

This suggests a need to deconstruct major concepts into sub-concepts and sub-sub-concepts that can explored and evaluated in small-scale, individual experiments. Once the sub-concepts have been refined, and confidence is gained in their feasibility and effectiveness, they can be integrated into more complex concepts for larger experiments. Eventually, the larger concepts can be integrated into a single concept for a more comprehensive series of experiments to explore the complete concept end to end. The following diagram illustrates this idea.



Progressive Experimentation

In years one and two, relatively simple sub-sub-concept experiments are conducted, and the results are integrated into three "medium-sized" sub-concept experiments in year three. In year four, all the parts are integrated for a "large experiment" to explore the complete concept. Throughout this process, sub-concepts will change – some will be improved, others may fail. Failure of a critical sub-concept could cause the complete concept to be rejected, but it is more likely that the learning that takes place in the early stages will cause the overall concept to be strengthened and refined.

The experiments in year four will also gain from the lessons learned in the preceding three years.

The diagram also illustrates why continuous experimentation is essential for developing and testing breakthrough concepts. If these experiments were conducted in sequence rather than in parallel, it would take at least 12 years to complete the exploration of the concept – not exactly the kind of timeline associated with a breakthrough. This kind of continuous experimentation builds momentum for transformation by providing a flow of new ideas and new approaches that build confidence in – and support for – the transformation concepts.

Experiment events may include seminars and wargames to explore and refine the concept. Since experimentation often involves the exploration of capabilities that do not yet exist, simulation plays an important role. Constructive simulations provide some quantitative insights, particularly about the expected performance parameters of future systems. However, constructive simulations do not take into account the key parameter of human performance. Human-in-the-loop (HITL) virtual simulation is therefore an essential tool, as it will permit learning about the interface of human operators with new technology, under conditions of stress, while facing a thinking, adaptive Red Team. HITL simulation will also allow human operators to evolve the concept by trying different tactics, techniques, and procedures – doing this with constructive simulation requires rewriting software code for every new idea.

Field simulations involving live forces are another experimental tool, one that may culminate an iterative, progressive campaign. However, not all experimentation needs to culminate in live field experiments. Field events do offer credibility, but they also bring their own artificiality. Variables become numerous and difficult to control, and repetition is much more difficult. Field events also attract visitors and, despite good intentions, can turn into something more akin to a demonstration than a true experiment.

Be tolerant of "failure" and open to surprise

Success in experimentation lies in discovering what works and what does not. It is disappointing to learn that a cherished idea is not as good as it first seemed, but a failed idea does not represent the failure of experimentation. The Chairman of the Joint Chiefs of Staff clearly understands the nature of experimentation and is willing to underwrite setbacks:

> "Joint experimentation will demand original thinking . . . . No doubt there will be occasional failures, but that doesn't concern me. Thomas Edison conducted 50,000

> experiments to develop a new storage battery. Asked if failures frustrated him, he replied: 'What failures? I now know 50,000 things that don't work.' Experimentation means the freedom to fail, because it is through such failures that we discover truths which help the next experiment. Thus we will ultimately reap the benefits of a *JV 2010*-capable force."[12]

Equally important is openness to the discovery that an idea works in ways different from what was anticipated. This requires that experiments be observed by people with the experience and judgment to see not only what takes place before their eyes, but also what might have happened if conditions or procedures had been even slightly different.

3. Use the Results Smartly

Seek early success without sacrificing bold goals

The United States Congress and other institutions, inside and outside government, are clearly looking for "transformation" even if they are not clear on how to measure progress. DoD (and more specifically US Joint Forces Command) needs to demonstrate progress to assure continued support for the experimentation program. Early success can demonstrate progress towards transformation and focus attention on the important issues associated with implementing the positive results of joint experimentation.

Be prepared to exploit success

Given the processes of government and the lead times associated with major change, even revolutionary change must proceed in evolutionary stages. When the objective is big change, however, it is essential to establish bold goals along an evolutionary path. The approach must be ambitious, lest big change be submerged in a tide of comfortable incrementalism. DoD cannot wait until all experiments are completed to begin planning for incorporation of ideas and concepts generated during experimentation. It takes time to develop and procure new materiel, but the other elements that together comprise a capability – doctrine, organization, training, leaders, people, and facilities – have their own cycles and lead times as well. The experimentation process must foster the co-evolution of all the elements – DOTMLPF – which, when combined, will produce a new capability.

Transformation can be thwarted by the rigidity of processes that allocate resources needed to implement and exploit new concepts. Flexibility is essential. Success must be anticipated and a process put in place to move promising experimental

[12] General Henry H. Shelton, "A Word From the New Chairman," *Joint Forces Quarterly,* Autumn/Winter 1997-98, p. 8.

products and results rapidly into the field, outside the normal cycle of budget preparation and review.[13]

The Predator Unmanned Aerial Vehicle, for example, proved itself highly effective at providing near-real-time, beyond-line-of-sight imagery when deployed to Bosnia as an Advanced Concept Technology Demonstration. Predator's success in real-world operations led to a decision to field it on a permanent basis, but implementation was slowed because insufficient consideration had been given to force structure and personnel issues.

Involve stakeholders and provide persuasive results

Achieving the right set of capabilities for joint force commanders of the future to dominate any adversary will require not only difficult doctrinal decisions, but also difficult investment decisions. Such decisions could be helped by experimental results, provided all stakeholders accept them as valid. To obtain the necessary buy-in, stakeholders must be involved in developing the ideas and concepts to be assessed. The process must immerse stakeholders in experiments – to let them "test drive" the ideas themselves.

General Hamilton Howze was a former tank commander, not an aviator, when he was named the Chief of Army Aviation. He was told he'd been chosen on the basis of his strong belief that mobility was the real key to battlefield success.[14] General Howze later wrote that one of the jobs he considered vital was selling all the pertinent parts of the Army on the proposition that many things useful to do in combat might be done in the air at a very low altitude.

> "To that end, we wrote the Command and General Staff College at Ft. Leavenworth to get the tactical problems they were currently presenting to their students; these we presented to any individual or group of officers we could get to listen. First we gave the problem straight, as C&GSC gave it; then we put a very few selected, attached light reconnaissance aircraft, attack aircraft, and troop-carrying aircraft on one side, but not the other, and presented the problem again; then we shifted the aircraft to the other side and gave it a third time.
>
> "The effect of a few aircraft on the outcome was astonishing. One side knew much more of the other's position, disposition, and activity; one could move critically-needed supplies or persons quickly, the other couldn't; one could cross part of its strength over hills and

[13] For a discussion of the extent to which such a process exists within DoD, see *Report of the Defense Science Board Task Force on DoD Warfighting Transformation*, September 1999.

[14] Interview with General Howze by Colonel Glenn A. Smith and Lieutenant Colonel August Cianciolo, *The History of Army Aviation, Senior Officer Debriefing Program*, Carlisle Barracks, PA, US Military History Institute, quoted in Rosen, *Winning the Next War*, p. 73.

rivers easily, the other couldn't. Indeed, one could beat hell out of the other, other things (besides aircraft) being equal. The little show was immensely convincing."[15]

Planning and executing a successful program of joint warfighting experimentation needs to take into account who the stakeholders are and what sort of results each is likely to accept as persuasive.

Aim at co-evolution of DOTMLPF

The object of experimentation is to discover and refine new military capabilities – new combinations of advanced technology (materiel), organization, and doctrine (tactics, techniques, and procedures). Each of these elements of capability has its own development cycle and its own lead time, as do the closely associated training, leader development, training and education, and facilities elements. A capability implemented before all those elements are in place and functioning risks failure. Therefore, to be effective, joint experimentation must aim at their co-evolution.

E. TESTING THE RECIPE: THE FIRST JOINT EXPERIMENT

The first joint experiment, *Attack Operations Against Critical Mobile Targets,* suggests some of the difficulties as well as the paths future joint experimentation needs to follow. The concept was developed to address the problem of theater ballistic missiles (TBMs), which dates back to the V-1 and V-2 rockets of World War II. Today, TBMs continue to proliferate, and may carry nuclear, chemical, or biological weapons. Attack operations – locating and destroying such weapons on the ground – is therefore a critical challenge for US military forces.

Because it was the first joint experiment, the objectives included learning how to conduct effective experiments and building a base of knowledge and tools for future experiments, in addition to exploring new concepts for prosecuting time-critical targets. The concept envisioned that sensors and sensor management technologies will evolve in the next 15 to 20 years to the point of enabling comprehensive coverage of objects in the battlespace. These technologies hold the promise of enabling joint forces to locate, track, and then attack TBM launchers and other critical mobile targets.

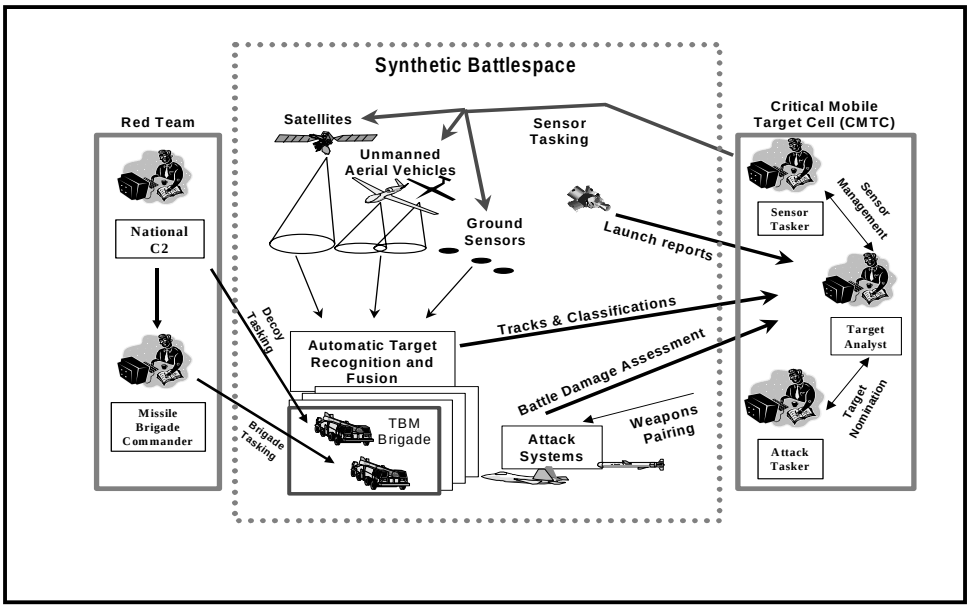
The challenge in conducting attack operations will be to maneuver different kinds of sensor platforms and sensors, merge their data into "engagement quality" tracks that provide target identification and location sufficient to permit their attack, and bring

[15] General Hamilton H. Howze, Ret., "Army Aviation 1955-1962: The Foundation of Air Mobility" in *Army Aviation,* December 31, 1992, pp. 26-34.

appropriate weapons to bear, when and where the targets are most vulnerable. The idea is not only to shorten response times between detection and engagement, but more fundamentally to provide a synoptic, shared, engagement-quality picture of the battlespace to enable trained teams to anticipate, detect, and attack fleeting targets.

The focus of the *Attack Operations* experiment was on command and control – a human-in-the-loop system able to adapt as necessary to integrate target tracks from a network of simulated future sensors, maneuver those sensors, and direct a weapons network against mobile missiles and their support systems. The objective was to learn how to find and destroy the missiles and their launchers on the ground, ideally before first launch.

The experiment team used the Synthetic Theater of War (STOW) simulation, an Advanced Concept Technology Demonstration sponsored by the Defense Advanced Research Projects Agency (DARPA), to create a synthetic battlespace integrating the air, land, sea, and space domains as well as the forces that operate in them.[16]



The *Attack Operations* Experiment Pitted Blue Against Red in a Simulated Future Environment

Into this environment were placed a mix of simulated future (circa 2015) sensors and weapons, integrated by a future command and control system. Experienced operators experimented with these simulated future capabilities, exploring new methods of

[16] The STOW simulation, since renamed Joint Semi-Automated Forces (JSAF), continues to be used by US Joint Forces Command as a human-in-the-loop virtual environment for experimentation.

command and control and new tactics to improve the speed and efficiency of targeting and attack. An independent Red Team provided dynamic free-play opposition in a series of trials.

In the experiment, sensor "hits" were sent to an Automated Target Recognition (ATR) exploitation and automated fusion emulation, which calculated the probability of correct identification. This probability, along with target location, speed, and direction, was then sent to the Blue Critical Mobile Target Cell (CMTC), where target analysts tracked each target, requested additional sensor coverage when required, and passed the target to an attack tasker, who paired it with an appropriate weapon and directed the attack. The CMTC provided the essential link between the sensing and attack functions.[17]

Some attributes of effective experiments were evident in this first experiment:

- It was a process of discovery, tolerant of surprise and failure. Players were allowed, indeed encouraged, to innovate during the trials. Outcomes were not scripted.

- It involved a Red Team (perhaps the most important attribute distinguishing experiments from demonstrations and tests). The Red Team both planned and operated Red Forces. Red planners – recruited from academia, industry, and government – developed a future ballistic missile force composed of solid and liquid fuel missiles, launchers with improved mobility, and enhanced camouflage, concealment, and deception measures. Red players provided the "OPFOR" (opposing force) to contest the Blue players during the human-in-the-loop portion of the experiment. Red was encouraged to develop tactics – such as salvo fires, "shoot and scoot" techniques, and enhanced camouflage, cover, and deception – reasonably available to an enemy in the 2015 time frame. Red and Blue were both allowed freedom to adapt internal processes and modify tactics, techniques, and procedures.

- It provided early immersion into the future so that subsequent experiments can explore paths to the capabilities envisioned. Set in the 2015 timeframe, it examined a mix of simulated future sensors and weapons, integrated by a future command and control system. Fully exploring the subject will require a campaign of continuous experimentation that progressively adds new variables and additional degrees of difficulty.

- It was an iterative process involving concept development, constructive modeling, and human-in-the-loop simulation. At each stage, changes were made based on results of the preceding step. If at any point the concept had "failed," the experiment could have been halted and the concept reworked to incorporate lessons learned.

[17] For a comprehensive review of lessons learned about designing and conducting joint experiments, see John Fricas, *Lessons Learned From The First Joint Experiment: Attack Operations Against Critical Mobile Targets*, IDA Document D-2496.

Perhaps not surprisingly – since this was the first experiment and the front-end planning stage was tightly time constrained – some attributes were not exhibited:

- Service involvement: The heart of the concept was a cell with the authority to task, in real time, sensors and weapons systems without regard to the owning Service. Cultural barriers traditionally prevent a Service from willingly handing over control of its assets. Fostering the changes in culture and doctrine necessary to achieve the capabilities envisioned will require including the Services as full partners in joint concept development and experimentation.

- International involvement: Because command and control is central to attack operations, and because it can succeed only if all the constituent parts of the system are interoperable, extensive participation by allies will be essential in developing the concept. Only one other nation took part in the first experiment.

- Involvement of key stakeholders: The lack of Service participation has already been cited, but perhaps even more crucial to any future implementation of the concept are the other unified combatant commanders. While the Services may fear loss of control over Service assets, joint force commanders are likely to see at once the advantages of a cell having the authority to task, in real time, sensors and weapons systems without regard to who "owns" them.

- Preparedness to exploit success: Preparing to exploit success is perhaps the major challenge facing future joint experiments. This first joint experiment did offer a set of DOTMLPF recommendations, in part to stimulate thinking about what to do with what is learned from joint experimentation. However, it remains for future experiments to consider much more seriously this formidable challenge.

F. CONCLUSION

An aggressive program of joint warfighting experimentation – systematically exploring new combinations of doctrine, organization, training, materiel, leadership, people, and facilities to assess their feasibility, evaluate their utility, determine their limits, and foster their co-evolution into fielded capabilities – will provide the means by which hard lessons can be learned and acted upon before US forces once again enter the ultimate laboratory of armed combat against an enemy of the United States.

Achieving fielded capabilities will require exploration of all the DOTMLPF elements, not just new materiel and command-and-control procedures. The first joint experiment provides a good foundation for a program of continuous experimentation aimed at co-evolving a new and much-needed capability, but more attention must be paid to integrating Service efforts, involving stakeholders, and providing persuasive results.

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Developing Metrics for DoD's Transformation

Joel B. Resnick

Draft Final

October 2000

October 31, 2000

What does the Lewis and Clark expedition of the earliest years of the 19th century have to do with DoD transformation in the 21st? The connection, as made in the attached paper, is that both are processes of discovery.

The most senior leaders of the Department of Defense (DoD)—the Secretary in his annual posture statement and two successive Chairmen of the Joint Chiefs of Staff in their Joint Visions 2010 and 2020—posit ambitious objectives for transforming US military capabilities. However, much of the specifics regarding the form and content of these future capabilities remain to be discovered. Therefore, these documents also call for a vital role for concept development and experimentation in the transformation process.

Experimentation implies a process of innovation and discovery, the possibility of false starts and a tolerance for both surprise and "failure" of concepts. The premise is that it's much better to discover flaws ourselves, through experiments, than to learn about them from our adversaries on future battlefields.

The need for an exploration phase presents challenges to the Department's leadership: how to motivate it, how to gauge progress, and how to explain it to others, including the Congress, the media, and US allies. This challenge is especially acute in an environment oriented toward success, quick returns, and zero defects. Metrics will be needed—metrics different from the familiar milestones with very explicit targets that are used to manage programs.

The paper describes the challenges facing DoD, provides a framework to consider metrics for transformation, and offers some suggestions on how DoD could start developing and using such metrics.

This paper does not necessarily reflect the views of the Institute for Defense Analyses or the sponsors of the Joint Advanced Warfighting Program. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation. We expect our own views on this topics will continue to evolve. Comments and questions are invited and should be directed to Joint Advanced Warfighting Program, ATTN: Joel Resnick, 1801 North Beauregard Street, Alexandria, VA 22311-1772, telephone (703) 845-6688, FAX (703) 845-6810, E-mail jresnick@ida.org.

Ted Gold
Director

Preface

This report was prepared for the Director, Defense Research and Engineering, in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, under the task order Joint Advanced Warfighting Programs (JAWP). It addresses the task order objective of generating advanced joint operational concepts and joint experiments to assist the Department of Defense in attaining the objectives of Joint Vision 2010. This report discusses warfighting transformation and developing metrics to gauge progress toward that goal.

Contributors to developing the ideas on which the paper is based include Dr. Theodore S. Gold, director, JAWP; Dr. William Hurley, JAWP research staff member; and Dr. Thomas Garwin at SAIC. The paper benefited from reviews by Colonel James H. Kurtz, USA (Ret.), and Dr. Williamson Murray, JAWP research staff members.

The JAWP was established at IDA by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP Team is composed of military personnel on joint assignments from each Service as well as civilian analysts from IDA. The JAWP is located principally in Alexandria, Virginia, and includes an office in Norfolk, Virginia, that facilitates coordination with the United States Joint Forces Command.

This paper does not necessarily reflect the views of the Institute for Defense Analyses or the sponsors of the JAWP. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation. The JAWP fulfills its role by helping to elaborate new concepts and capabilities, conduct joint experiments, integrate related activities, and prepare for implementation. We expect our own views on these topics will continue to evolve.

Contents

Illustrations

Introduction

This paper is about DoD warfighting transformation and developing metrics for that transformation.

Transformation means "change," but in the National Defense Panel (NDP) Report (December 1997) that first proposed the transformation of the Department of Defense (DoD) it meant "big change" or "bold change." Two years later, the Defense Science Board (DSB) Task Force Report on DoD Warfighting Transformation (October 1999) described it as "pursuit of bold new ways of conducting military operations to meet new security challenges of the 21st century."

Today, the Secretary of Defense and Chairman of the Joint Chiefs of Staff have committed themselves to DoD's transformation in support of JV2010 (and its update, JV2020), and to concept development and joint experimentation as a means to explore transformation. However, they have yet to define their specific objectives for a transformed force.

The paper first sketches several pictures of transformation—its differences from most challenges the United States has faced, the various perspectives on it, the rationale and objectives that might define it, and whether DoD is transforming itself today. What becomes evident is that transformation is a different and difficult kind of activity. There are no agreed-upon specific objectives—no precise problem to solve, threats to handle, or opportunities to exploit. Consequently, part of any transformation activity has to aim at identifying the ends of transformation—as well as the ways and means to reach them.

Transformation may be a different kind of activity for DoD but, as the paper suggests, it has precedents. A good example is the Lewis and Clark Expedition. While motivated in part by fear of competition from the British, what proved important about it was that the exploration of new territory expanded US interests (and claims), and set the stage for the westward expansion of the United States.

The paper looks next at why the Secretary and the Chairman need metrics during the current exploratory phase of concept development and joint experimentation. The reasons have more to do with encouraging innovative exploration, and explaining the process of transformation, than they do with managing it.

The paper then offers some illustrative metrics for key aspects of the exploratory phase; namely, inputs provided, potential processes, and intermediate results. One major intermediate result is the set of changes to DOTMLPF that would provide the basis for pursuing the capabilities needed to implement a specific operational concept.

The paper ends with a set of key conclusions.

What's Different About "Transformation"

Transformation is different from most big challenges the US military has faced because it involves both unknown adversaries and a low degree of mission-specificity. Figure 1 illustrates this point.

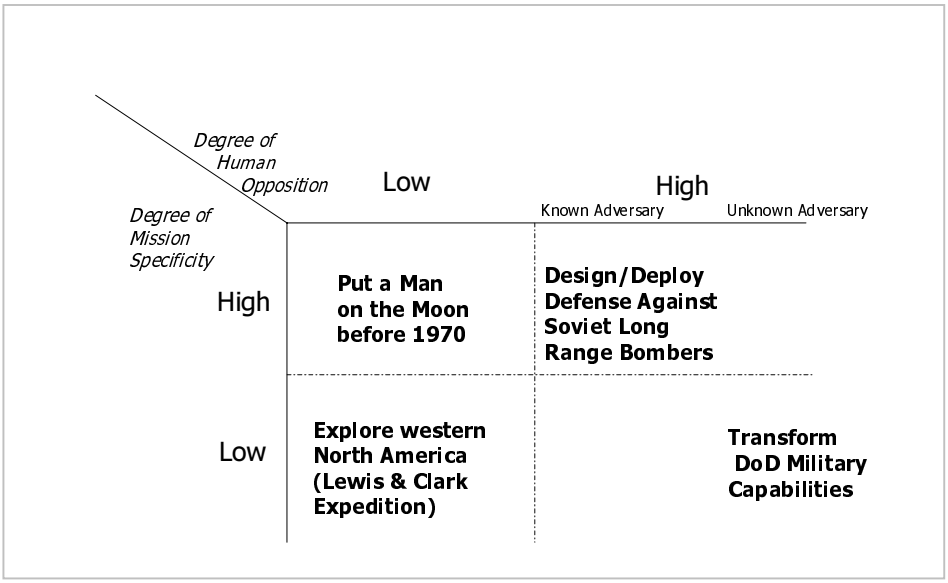

Figure 1. Transformation Is Different

- In the early 1960s, President John F. Kennedy proposed that the United States send men to the moon and return them to earth before 1970. This was a highly specific mission with no human adversary, although there was certainly competition with the Soviet program.

- In the 1950s, the United States developed and deployed a nation-wide air defense against Soviet inter-continental bombers. This involved a specific mission, but faced the complication of an adversary who could change his force posture and operational concepts to counter US defenses. In the 1970s the United States abandoned this de-

fense because the Soviets deployed large numbers of inter-continental ballistic missiles, which air defense interceptors could not counter.

- In 1803, the Lewis and Clark Expedition set out on a broad mission to "explore the Missouri River" and find "the most direct and practicable water communication across the continent for the purpose of commerce" (the broad objective). However, Lewis and Clark did not worry about British interference with their mission, and they carried gifts to win over any Indians they encountered (who generally treated them with benign neglect).

- Today, DoD is pursuing transformation—exploring new operational concepts and capabilities. Like the Lewis and Clark Expedition, this effort represents a broad mission. But DoD confronts the further complication of the needing to anticipate the efforts of unknown future adversaries to thwart the new capabilities.

Transformation is also different from most DoD activities because it depends on the eye of the beholder. Consider the difference in perspective of the Secretary and Chairman—who are charged with the responsibility for major change in DoD—on the one hand, and the Services and CINCs on the other.

- The Chairman has discussed transformation in terms of providing a major advance in the operational capabilities of the Joint Task Force (JTF) commander and CINCs (e.g., decisive early operations by joint air, sea, space, and ground forces in the face of access denial). His focus, and that of his advisors, has been on inter-operable and "born-joint" capabilities, ready and trained JTF C2, and new capabilities for intelligence, surveillance, and reconnaissance (ISR)—all in support of joint commander.

- The Secretary has spoken in general terms of the need for major increases in operational capabilities (the output). And as the manager of all DoD resources, he has an interest in achieving needed capabilities with fewer resources, if possible (the input).

Dramatic changes in Service programs and functional CINC capabilities could be described as "transformation."

- The Services are pursuing many dramatic changes in the FYDP that could "transform" their capabilities, e.g., the Army standing up a lighter, wheeled brigade, the Navy ex-

ploring automated ships requiring smaller manning levels, the Air Force deploying more UAVs.

- The functional CINCs are getting many new capabilities, e.g., TRANSCOM with faster deep-draft RO/RO ships, SPACECOM with new computer network attack capabilities.

- But unless these changes produce a major increase in operational capabilities of JTF commanders, or a major decrease in resources needed, such changes will not represent "transformation" from the perspective of the Secretary and Chairman.

Finally, transformation is different because the specific objectives are not yet defined. JV2010 provided a mandate for pursuing transformation and the Revolution in Military Affairs (RMA), but neither it nor JV2020 provide specific objectives or priorities for allocating major resource to new programs. The Secretary and Chairman have not chosen, as yet, to provide strong direction on specific objectives or resource priorities. Nonetheless, it is easy to identify security challenges that could provide the rationale for major changes in DoD capabilities:

- Near Term Problems: Several near-term threats by regional adversaries could endanger the current DoD approach to power projection. These include the use of BW/CW and mines to deny access to ports and airfields (in the US and in theater), as well as the use of theater ballistic missiles against host nation infrastructure and cities. (A military peer competitor could be a problem for the longer term.)

- Personnel & Resource Tensions: DoD faces a major problem in identifying how the Services can organize, train and equip their forces, and how the CINCs can operate them, to reduce PERSTEMPO and personnel recruitment/ retention problems, and to alleviate the procurement bow-wave.

- Difficult Environments for Future Operations: New ways are needed to do rapid and decisive joint operations with land, sea, air, and space capabilities in SSCs and MTWs, and to conduct urban operations in the face of concern about media focus on military and civilian casualties and collateral damage.

- Lessons Learned From Business & History: A lesson from the ongoing revolution in business affairs—that disruptive change is essential for survival—is a call for exploring major changes.

- New Opportunities: A new geo-strategic environment (e.g. asymmetric regional threats, no early peer competitor) encourages exploring revolutionary new technologies (e.g., information, biotechnology) and the nature of military advantage in an increasingly commercialized and globalized world.

In sum, there are certainly many potentially good reasons for major changes in DoD. But, it is not easy to identify the most compelling reason for major change.

Is DoD Transforming Today?

Given the many reasons for major change to DoD, is the Department actually transforming itself today?

- The National Defense Panel concluded that DoD was not planning for major changes and called for $5-10B to fund enablers for a transformed force. (It provided some recommendations for Service forces, but did not explicitly define the transformed force.)

- The DSB Task Force on Warfighting Transformation addressed this question and concluded that "Transformation is about defining and implementing a vision of the future different from the one embedded, if only implicitly, in DoD's current plans and programs." It did not find "a comprehensive DoD-wide strategy and roadmap" for transformation.

For the NDP and the DSB Task Force, transformation clearly meant fundamental change in the sources of military advantage as well as the means available and the ways that the US military would fight and win wars. It meant changing from the current path to a new one involving new concepts and capabilities (not just incrementally improving today's capabilities).

But even if DoD has no comprehensive strategy and roadmap for transformation, it has taken a major step towards defining and creating a different future force. In May 1998, the Secretary assigned USACOM (now JFCOM) responsibility for a new Joint Concept Development and Experimentation effort—to explore, demonstrate and evaluate joint warfighting concepts and capabilities. The USACOM charter states that experimentation should "identify the breakthrough warfighting capabilities necessary to achieve JV2010 and future CJCS visions."

This assignment of responsibilities implicitly recognized that transformation currently lacks the specificity Americans expected from major initiatives during the Cold War (like putting men on the moon or defending against Soviet inter-continental bombers). So a necessary

part of transformation today is an exploratory phase—to help define where the US military might go and how it might get there—in many ways like the explorations of Lewis and Clark.

Lewis and Clark Expedition

On becoming President in 1801, Thomas Jefferson implemented a plan he had pursued for twenty years—exploring western North America. Part of his concern was that British exploration in the west would lead to British claims to all the territory in the vicinity of the Missouri and Columbia Rivers. In response to Jefferson's request, Congress appropriated $2,500 for an expedition to the Pacific Ocean. In 1803, Jefferson gave the mission of exploration to his private secretary, Captain Meriwether Lewis, who recruited Lieutenant William Clark to share command of what they came to call the "Corps of Discovery."

The mission's declared purpose was broad: study the Indians; observe the flora, fauna, climate and geography; and explore the upper Missouri and on to the Pacific Ocean. The mission statement Jefferson provided Lewis and Clark was brief:

> The object of your mission is to explore the Missouri river and such principal stream of it by its course and communication with the waters of the Pacific ocean, (whether the Columbia, Oregon, Colorado or any other river) may offer the most direct and practicable water communication across this continent for the purpose of commerce.

Water communication for commerce was an emerging technology in the early nineteenth century. Americans were looking into building a canal in upstate New York to connect Albany on the Hudson River and Buffalo on Lake Erie, and through them the port of New York City with the lands and communities bordering all the Great Lakes. And there were discussions of a canal along the Potomac River to open up the interior of Maryland to commerce.

After Lewis and Clark returned from their two-year mission, Jefferson reported to the Congress in December 1806:

> The expedition of Messrs. Lewis and Clarke, for exploring the river Missouri, and the best communication from that to the Pacific Ocean, had had all the success which could have been expected. They have traced the Missouri nearly to its source, descended the Columbia to the Pacific Ocean, ascertained with accuracy the geog-

> raphy of the interesting communication across our continent, learned the character of the country, of its commerce and inhabitants…

The Lewis and Clark mission was a success. In exploring new territory, it strengthened US interest in the west and claim to territory in the competition with the British. It also disclosed that—contrary to Jefferson's hope—there was no direct and practicable water communication across the continent. The emerging technology of canals with locks could support the building of the Erie Canal in New York and the Chesapeake & Ohio Canal in Maryland, but not trans-continental commerce. Sixty years later two new technologies provided the breakthrough—the trans-continental telegraph and the trans-continental railroad. The Lewis and Clark Expedition paved the way for this breakthrough.

The significance of the Lewis and Clark Expedition to the problems confronting the US military in the twenty-first century lies in the importance of exploring "new territory." The German army and the US Navy faced "new territory" in the early 1920s when new weapon systems (the tank and the airplane) were clearly going to change the conduct of ground and naval operation, but understanding the extent and direction of those changes demanded extensive exploration.[1]

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[1] See, among others, Williamson Murray and Allan R. Millet, Military Innovation in the Interwar Period, Cambridge, 1996.

Some Premises for Developing Metrics

Today, the activities towards DoD's transformation are akin to the explorations of Lewis and Clark. This has considerable implications for the kinds of transformation activities and metrics required.

One implication is the high potential value from a wide-ranging program of exploration — both to exploit revolutionary technologies in an increasingly commercialized and globalized world and to meet the challenges of the availability of such technologies to future adversaries. Another is that this wide-ranging exploration has to take place without well-defined objectives. Consequently, surprise, false starts, and dead ends will inevitably occur and should be expected. Only as the exploration process proceeds can clear objectives be defined.

A different implication is about the kind of metrics needed. Since transformation will require linked changes across many boundaries—Service-Service, DoD-interagency, US-Allied, CINC-NGO—it is inescapably the job of the DoD Chief Executive Officers (CEOs), the Secretary and the Chairman. They will need a set of metrics appropriate to the exploratory phase of the transformation process. These cannot be like the milestones used to manage specific programs to well-defined objectives. The appropriate goals for developing metrics today for DoD's CEO's are to encourage and explain DoD's pursuit of transformation with a multi-year program of exploration.

- Metrics can help encourage a vigorous and innovative exploratory program. They can help overcome obstacles within the Department's bureaucracy and can encourage the funding of efforts to explore new concepts with the potential for major change.

- Metrics can help explain the process of transformation, and the progress toward it, to people inside DoD and outside (e.g., Congress, media, Allies), well before the DoD force has any fundamentally new capabilities.

These metrics can be quantitative or qualitative, so long as they serve to encourage and explain the quest for transformation and convey to diverse audiences an objective sense of progress (or good reasons for a lack of progress) in exploration.

Illustrative Metrics for the Exploratory Phase

The simple input-output model shown in Figure 2 is a useful framework for looking at metrics for the exploratory phase of transformation.

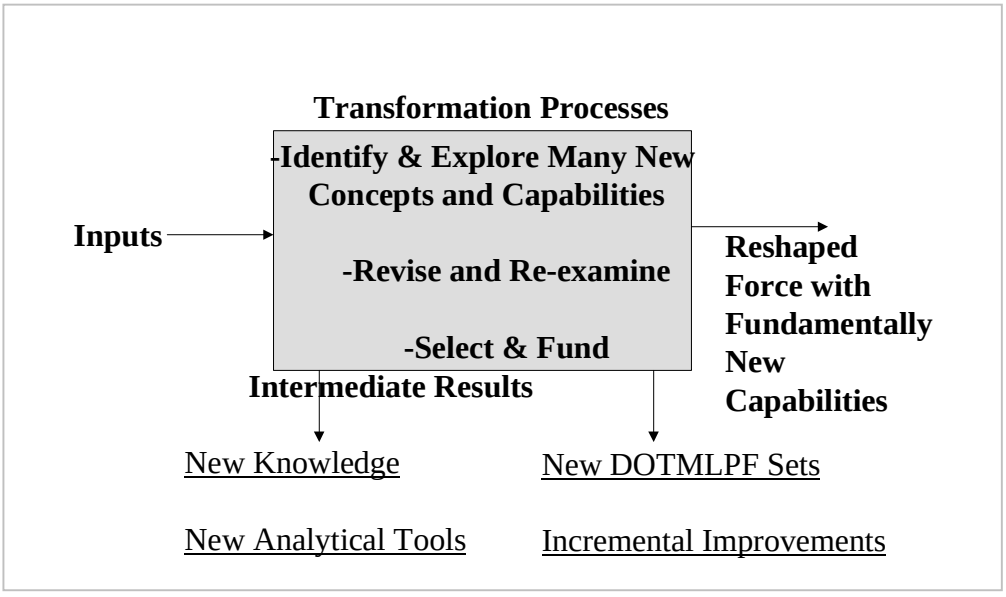

Figure 2. Model for Transformation

The exploratory phase involves the inputs provided to explore new operational concepts and associated capabilities; the processes established to conduct the exploration and use its results to foster transformation; and the intermediate results which do not themselves involve major new capabilities, but which lay the basis for them.

Metrics for Inputs- the Key Resources

Inputs involve the resources committed to transformation—among them dollars and people. The challenge is deciding what to include in a situation where proponents for all activities—new and existing—have incentives to claim their programs as key to transformation.

The following two metrics are necessary:

- the trend in funding and personnel (US and Allied) for joint concept development and experimentation, and
- the trend in funding for S&T programs supporting key enablers for transformation (e.g. an information utility).

Business literature on major change identifies a resource more critical to success than dollars and people; namely, commitment of the CEO**.** Any metric for gauging the commitment of the Secretary or Chairman will raise sensitive issues. Nonetheless, it would be worthwhile to develop a metric to use as a self-check for personal involvement (but not as a report card).

Metrics for Transformation Processes

The transformation processes will involve many activities. Some are unique, tied solely to transformation, e.g., Service and Joint programs on new concepts or capabilities and efforts to define appropriate measures of effectiveness (MOEs) for new capabilities. Some support both transformation and near-term modernization, such as Advanced Concepts Technology Demonstrations (ACTDs). Some are normal DoD processes to obtain any new capability.

To avoid needless argument, the metrics chosen should be for activities clearly related to the exploratory phase of transformation and to overcoming the cultural barriers to the exploration and implementation of new operational concepts and capabilities, e.g.:

- Presence of a diverse and innovative program of concept development and experimentation by the Services, JFCOM and the other CINCs, and in addition a forum for engaging in a keen competition of ideas.
- Extent and character of participation by senior people (from Services, Joint Staff, and CINCs) and by institutions (like Service schools) in the exploratory process (preferably fully engaged and not just observers).
- A process intended to address simultaneously a set of DOTMLPF changes and to provide their speedy implementation.

- Divestitures identified to fund the implementation of new concepts, or an ongoing process to identify these divestitures.

- A new emphasis at the places that enable cultural change—the schools providing professional military education—on joint operations and the perspectives and needs of JTF commanders and CINCs.

- The standing-up of a "Corps of Discovery" in 2003, on the 200th anniversary of the beginning of the Lewis & Clark Expedition.

Metrics for Intermediate Results

Intermediate results can provide steps on the path to transformation. Metrics can be developed for several types of intermediate results from concept development and joint experimentation. One type of intermediate result is new knowledge that clarifies the concepts and capabilities for a transformed force. Figure 3 illustrates one way to show the maturity of understanding of new concepts.

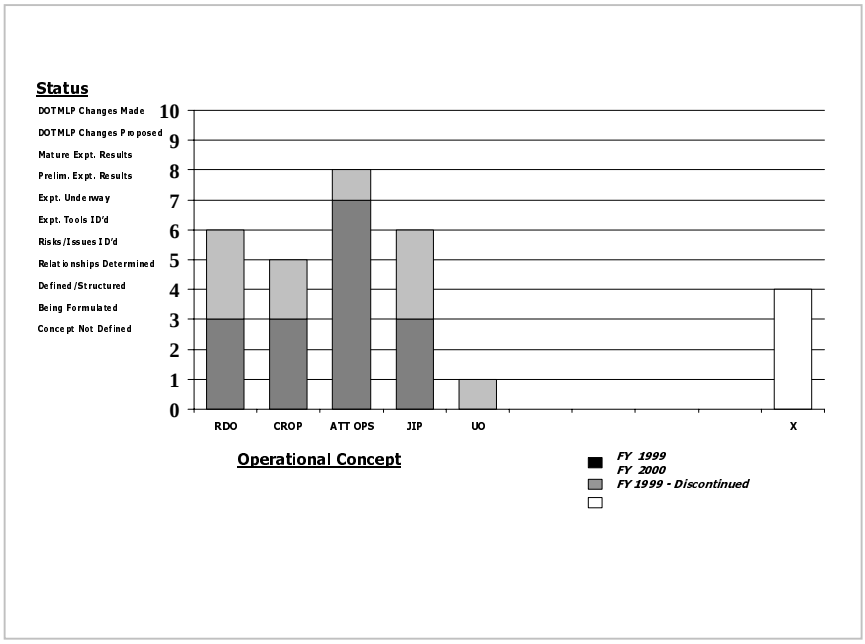

Figure 3. Example of Concept Status (Notional Data)

Progress in the stages of experimentation is on the vertical axis. This figure can show the relatively maturity of experimentation on the attack operations concept and the advances

made in 2000, and can contrast it with the relatively immature state of new concepts for urban operations. It can also show where new concepts have been abandoned.[2]

New analytical tools to help explore concepts provide another valuable intermediate result. Metrics here would include:

- Creation of a new model or simulation, e.g., a major improvement to existing simulations to permit better experiments on new concepts for urban operations.
- Development of a new MOE, e.g., a measure that captures information and decision superiority critical to JV2010 and 2020.
- Establishment of a new center of excellence to capture and share what has been learned, e.g., about how to do effective attack operations against critical mobile targets based on exploratory simulations and experimentation.

Among the later intermediate results are co-evolved sets of DOTMLPF changes that could implement a new operational concept and its associated capabilities. It is important to focus on DOTMLPF sets, rather than individual changes (e.g. a new paragraph in the next doctrine manual), to ensure attention to the set of changes needed to achieve the desired capability.

Incremental improvements that support or enable a transformed force can be important intermediate results. Metrics here would include:

- Transition of enabling capabilities from S&T to fielded capabilities.
- Leave-behinds from an ACTD that provide new ISR capability to part of the deployed forces.
- Changes in the personnel system to recruit, train, and retain people with information technology skills essential to a transformed force.
- New doctrine for urban operations that new drives joint training.

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[2] Note that the scores shown measure status—not the value of the concept for transformation. That assessment must rely on the judgment of the decision-maker.

Metrics for Ultimate Results- Reshaped Forces, Fundamentally New Capabilities

The exploratory process can give the Secretary and Chairman the means to provide guidance that is more specific than JV2010 or 2020. This involves selecting for implementation a specific set of DOTMLPF changes that would provide the capabilities needed to enable a new operational concept. The selected concept could take a variety of forms, e.g., a new way of rapidly and decisively fighting and winning wars, or a new operational-level concept for urban operations.

Once new operational concepts and associated capabilities have been selected for implementation, milestones would be developed to manage programs and measure progress towards implementation. Metrics for the new capabilities would be the MOEs that capture what the new concept is about, e.g., mission performance under various conditions. Developing these MOEs would occur as part of the exploratory phase on a particular operational concept.

Metrics would be needed to track the implementation of the DOTMLPF changes, to ensure they stay on schedule and provide synergy, and not dysfunction.

Conclusions

Transformation is a different—and difficult—kind of activity for DoD to pursue today, because of its inherent uncertainties and ambiguities:

- in identifying future adversaries and understanding their likely strategies;
- in the perspective for viewing transformation; and
- in the specific DoD objectives and the ways and means to reach them.

The near-term efforts must be viewed as an exploration of "new territory," to help define specific objectives worthy of pursuit and appropriate ways and means to achieve them.

The Secretary and Chairman need metrics to encourage a wide-reaching exploratory phase and explain (inside and outside DoD) the process and progress towards transformation. Their metrics should not focus on the fundamentally new capabilities of the reshaped force. Rather they need to capture the exploration of "new territory":

- the inputs provided to the exploratory activities (including trends in funds and personnel as well time commitment of the Department's leaders);
- the processes through which DoD would conduct and make use of these activities; and
- the intermediate results (including new knowledge about operational concepts, new models/simulations and MOEs, new set of DOTMLPF changes, and incremental force improvements).

The time to develop metrics for the exploration of "new territory," and to use them to encourage and explain DoD's process for transformation, is now.

JAWP

War and Urban Terrain in the Twenty-First Century

Williamson Murray

November 2000

Introduction

One of the major debates underlying current U.S. defense policy is the question of what many have casually termed "urban operations," or fighting in cities. Unfortunately, the term itself has become thoroughly misleading. To most defense experts, it now connotes operations in major cities around the world. Not Surprisingly, those opposed to the idea of urban operations have conjured up images of U.S. forces fighting their way into and through cities similar to Stalingrad and Berlin, those atrociously costly battles in World War II. Certainly, the record of combat in cities throughout the twentieth century is a gloomy one. Warsaw (1939 and 1944), Leningrad (1941-1942), Stalingrad (1942), Manila (1945), Berlin (1945), Seoul (1950-1951), Hue (1968), Beirut (1982) and Grozny (1995/1999), involved unmitigated suffering on the part of victor and vanquished alike.[1] Moreover, in the cases of Leningrad and Manila, the slaughter of civilians caught in the battle zone reached into the hundreds of thousands—a result that would today carry with it catastrophic political consequences, at least for U.S. strategy.[2]

The historical picture is so wretched that it suggests that no one in his or her right mind could possibly ever want to commit military forces to combat in cities. In the case of first-world powers, especially the United States, the cost both to one's own forces as well as to civilians within cities presents psychological and political barriers that seem to make it virtually impossible to fight directly for the control of cities in the twenty-first century, as occurred in the last century. In addition to the constraints of casualties and collateral damage, the geographic layout of cities negates most of the technological advances of the past several decades, including stealth, precision, communications, and ISR.[3] Fighting in the urban environment would thus seem to offer a return to the urban brawls of industrial age war.

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1 Soviet casualties in the take down of Berlin in April/May 1945 appear to have been 304,887 killed, wounded or missing along with 2,156 tanks and Sp guns, 1,200 guns and mortars, and 527 combat aircraft—a butcher's bill that makes Eisenhower's decision to halt Allied forces on the Oder River an entirely sensible one. John Erickson, *Stalin's War with Germany*, vol. 2, *The Road to Berlin* (London, 1983), p. 622.

2 The mere destruction of a Vietnamese village and the ensuing comment by a U.S. advisor that "we had to destroy it to save it" had a considerable impact on public perceptions of the war in the United States in the late 1960s.

3 I am indebted to Joel Resnick of the JAWP for this point.

Yet, unfortunately Western military organizations had better think about the problems associated with fighting in urban terrain, because they are going to be fighting there, like it or not. The increasingly urbanization of the world's face over the past half century, as many have pointed out, also carries with it considerable consequences. The fundamental issues have to do with two powerful facts: as Clausewitz underlined all too clearly, wars in the twenty-first century, as over the past 2,500 years, will occur for political reasons, and cities will therefore become the target of significant military operations.[4] In the final analysis cities represent the heart of human political life, and victory over most states requires the occupation of their cities.

Second, in the early twentieth-first century the increasing spread of human habitation means that complex urban terrain will confront armies wherever they conduct military operations—and not just in cities. Thus, one might conduct a major military operation that entirely misses the major cities of an opponent. Yet the capture of key logistical nodes, crucial terrain features, or road networks will require military forces to fight in the urban sprawl that spreads across the face of the world's continents. These two factors form the heart of the issues that this paper will address in examining the future of military operations in urban terrain.

War in Cities: The Record in the Twentieth Century

History suggests much about the crucial importance of cities. The issue is not just whether increasing numbers of people around the world are moving into urban centers. Rather, the reality is that since the seventeenth century, armies have focused on the capture of cities in their military campaigns—not on the mere capture of terrain.[5] This is

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4 The disastrous Peloponnesian War began with a surprise strike by Theban elite troops against the city state of Potidea, a close ally of the Athenians. In the urban landscape of what would today be considered a relatively small town, the initial force of Thebans became disoriented, trapped, and then destroyed by the Potideans. See Thucydides, *History of the Peloponnesian War*, translated by Rex Warner (London, 1954), Book 2.

5 In the conduct of Allied operations in August 1944 after the breakout from Normandy, Eisenhower attempted to bypass Paris in the rush to the German frontier. But the political realities of France in 1944 as well as the attitudes of America's French allies quickly forced a change in plans and the commitment of the French 2nd Armored Division as well as U.S. forces to the liberation of the French capital. See Larry Collins and Dominique Lapierre, *Is Paris Burning?* (New York, 1965).

the result of the fact that cities not only represent important financial and economic centers, but also represent the psychological heart of national resistance as well.

The twentieth century has seen cities as the focus of virtually all military operations. The Schlieffen plan of 1914 aimed not only at the destruction of the French Army, but the capture of Paris, France's administrative and political center.[6] Similarly, the Wehrmacht's 1940 campaign aimed at the capture of Paris after the first blow had destroyed the Allied left wing in the Low Countries.[7]

At least in the minds of the German Army's leaders, if not their *Führer*'s, "Operation Barbarossa," the invasion of the Soviet Union in summer 1941, had Moscow as its most important goal.[8] Well into the 1990s, many military analysts have supported the postwar contentions of German generals that, had the Wehrmacht been allowed to capture Moscow in fall 1941, instead of being diverted to the Ukraine by Hitler's strategic and economic interests, the Soviet Union might well have collapsed.[9] The following year found the Germans entangled in a massive effort to capture Stalingrad on the banks of the Volga—a battle that resulted in a major defeat for German arms.[10] At the same time that the Germans were stalled in front of Moscow, the Japanese began their great offensive into Southeast Asia. Here again military operations focused on the capture of major cities: in the Philippines on Manila, in Malaya on Singapore, and in Burma on Rangoon.

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6 For discussions of the role of Paris in German planning for the Schlieffen Plan see among others: Holger Herwig, *The First World War, Germany and Austria-Hungry, 1914-1918* (London, 1997); Gerhard Ritter, *The Schlieffen Plan, Critique of a Myth* (New York, 1958); and Barbara Tuchman, *The Guns of August* (New York, 1962).

7 For the German consideration of a drive to the Channel Coast in 1940, had the initial crossing of the Meuse by the rifle regiments of the panzer divisions failed, see Williamson Murray and Allan R. Millett, *A War To Be Won, Fighting the Second World War* (Cambridge, MA, 2000), pp. 59-60.

8 The most thoroughly researched account on the German side remains Horst Boog, et al., *Das Deutsche Reich und der Zweite Weltkrieg, Der Angriff auf die Sowjetunion* (Stuttgart, 1983).

9 That is not the view of this author, but the capture of Moscow would certainly have placed the German Army in more defensible positions over the terrible winter of 1941/1942. But one might also note that a German drive that reached Moscow might also have resulted in a blood bath equal to that experienced by the Sixth Army at Stalingrad in fall 1942.

10 For the Stalingrad campaign as well as the ferocious fighting that took place in the city's urban terrain see Horst Boog, et al., *Das Deutsche Reich und der Zweite Weltkrieg, Die Ausweitung zum Weltkrieg und der Wechsel der Initiative, 1941-1943* (Stuttgart, 1990).

When the Allies went over to the offensive in 1943, their operations likewise centered on the capture of major cities as intrinsic to strategic and political goals. From 1943 through spring 1944, Rome represented a glittering prize for British and American forces fighting on the Italian peninsula. In fact, the American ground forces commander, General Mark Clark, was so enamored by the vision of capturing Rome that he allowed the German Tenth Army to escape while he drove his American troops to capture the eternal city in June 1944.[11] Early the following year, Douglas MacArthur enthusiastically threw his U.S. Army divisions into a major effort to liberate Manila from the Japanese.[12]

And in the final collapse of the Third Reich, the Soviets suffered horrendous casualties in capturing Berlin. As the Red Army approached Berlin, Winston Churchill, prime minister of Britain, pleaded with Eisenhower to get Allied forces to the German capital before the Soviets. By the end of the war the Soviets had "liberated," not only Berlin, but Budapest, Prague, and Vienna. Churchill argued strongly after the war that the Western Powers had made a serious political mistake in allowing the Soviets to capture all the great capitals of Central Europe.[13]

The post-World War II period has seen a continued emphasis in military operations to capture, hold, or deny cities against enemy military forces. Seoul became a great battle-ground in fall 1950 as Marines and Soldiers wrecked the Korean capital in their efforts to liberate it.[14] During the following year, UN and communist forces fought over the wreckage twice more, before the Americans finally liberated it for good in spring 1951. In 1968 the Communist North Vietnamese and their local supporters, the Viet Cong, launched the Tet offensive, which aimed at encouraging popular uprisings that would lead to the capture of South Vietnam's cities, including Saigon and the ancient capital of

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11 See Dominick Graham and Shelford Bidwell, *Tug of War, The Battle for Italy, 1943-1945* (New York, 1986), pp. 335-341.

12 For an account of MacArthur's decision see Williamson Murray and Allan R. Millett, *A War To Be Won, Fighting the Second World War* (Cambridge, MA, 2000), pp. 495-500. For the destruction of Manila see Alfonso J. Aluit, *By Sword and Fire: The Destruction of Manila in World War II, 3 February--3 March 1945* (Manila, 1994). See also,Richard Connaughton, John Pilmott, and Duncan Anderson, *The Battle for Manila* (London, 1995).

13 From the perspective of a decade after the end of the Cold War, Churchill's arguments appear less persuasive, particularly when one considers the casualties suffered by the Soviets in taking those cities.

14 T.R. Fehrenbach's *This Kind of War* (new York, 1964) still remains the classic account of all aspects of the Korean War.

Hue. The attacks failed to result in a popular uprising in Saigon, although the television images of the fighting in that city, as Communist commandos reached the doors of the American embassy, had a profound affect on the willingness of the American people to continue their support for the war. In the case of Hue, the North Vietnamese succeeded in capturing much of the city and forced their American and South Vietnamese opponents into a lengthy and politically debilitating siege.[15]

While the Gulf War did not result in any significant fighting in cities, since the Iraqis abandoned Kuwait City without a fight, America's other major military commitments in the last decade and a half have resulted in combat in cities. "Operation Just Cause" in 1989 focused US operations on the capture of Panama City to overthrow Noriega's thuggery. Similarly the ill-fated American and UN effort to suppress tribal gangs in Somalia resulted in the shoot out in Mogodieshu.

Outside of the American experience, cities have played an equally important role in the military history of the last half of the twentieth century. The Battle of Algiers resulted in a major French victory over the Algerian FLN in the late 1950s.[16] But the resulting publicity over French methods in gaining that victory played a major role in undermining the political support in France required to continue the conflict. Russian efforts to destroy the Chechen Republic, first in 1994 and then beginning this past year, have focused on the capture of Grozny, even after it had become a worthless pile of rubble.

This brings us to the crucial question of what it is about cities that makes their capture so important to the conduct of military operations. From a military perspective, the most obvious is the fact that cities and towns, even in some cases relatively small centers of urbanization, offer the key to the logistical and operational landscape. Montgomery concentrated British and Canadian military operations in the first month of Operation OVERLORD on the capture of the Norman city of Caen, because its capture would

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15 For a popular account of the fighting in Hue see Eric Hammel, *Fire in the Streets: The Battle for Hue, Tet 1968* (New York, 1996).

16 The movie *Battle of Algiers* remains a must see for anyone concerned with understanding a war against terrorist within the confines of a city. The Battle of Algiers is examined by Alistair Horne in his masterful history of the Algerian conflict: *A Savage War for Peace, Algeria 1954-1962* (New York, 1967).

allow the Allies to control the road network in eastern and southern Normandy and to fight the main battle east of the bocage country.[17]

Later in 1944, Montgomery's greatest failure came when his Twenty-First Army Group captured the port of Antwerp in undamaged condition in early September 1944, but neglected to open the Scheldt up for eighty-five days.[18] That failure placed a severe logistical crimp in the ability of Allied armies to project military power across the Franco-German borderlands. In the end, it was a major factor in prolonging the war into spring 1945.[19] Thus, the most obvious importance of cities lies in their placement on the geographic and logistical landscape. They are the essential components in the movement of people and goods over the surrounding terrain. All major transportation networks link cities and towns. In the end roads and railroads funnel military operations to and through urban terrain. That reality will obviously not change in the next century.

But cities also possess a political and psychological importance that transcends their specific industrial and economic importance. The British held the North-African port of Tobruk for the last half of 1941 partially because of the difficulties its possession caused the *Afrika Korps'* logistics and its ability to conduct operations against Egypt. But the dogged resistance of the Tobruk garrison eventually took on an importance of its own in terms of Allied perceptions and propaganda.[20] Those perceptions led Churchill in June 1942 to make the serious mistake of asking his commanders in the Middle East to hold the port after the disastrous defeats in the Gazala battles allowed Rommel to move against Egypt. The result was another British defeat, as Rommel launched a surprise attack against the ill-prepared garrison at Tobruk.

Several months later in August 1942, the Germans began massive efforts to drive the Red Army out of Stalingrad. The strategic and geographic importance of "Stalin's city" in controlling the traffic on the Volga had been a major factor in German strategic

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17 See among others Carlo D'Este, *Decision in Normandy* (New York, 1983) and Max Hastings, *Overlord, D-Day and the Battle for Normandy, 1944* (London, 1984).

18 For the dismal results of Montgomery's inaction in early September see in particular R.W. Thompson, *The 85 Days, The Story of the Battle of the Scheldt* (New York, 1957).

19 See Williamson Murray, "A World in the Balance," *Military History Quarterly*, Autumn 2000.

20 Major General I.S.O. Playfair, The Mediterranean and Middle East, vol. 3, September 1941 to September 1942, British Fortunes Reach Their Lowest Ebb (London, 1960), pp. 244-275.

planning for *Operation Blau* (Operation Blue) that aimed to break the Soviet Union off from the vital oil supplies coming out of the Caucasus. But the fighting for the city soon took on a life of its own, as Hitler came to view the battle as a contest of wills between himself and the Soviet dictator. Thus, the Germans threw their reserves into a battle that soon produced casualty levels well beyond any reasonable expectations of gains. In the end the cost to the Wehrmacht a level of attrition it simply could not maintain, and the Soviets were able to surround the city and destroy the German Sixth Army.

In the largest sense, cities have become identified with national existence. Paris, especially in the eyes of the Parisians, is France, and on it rests the fate of the French nation. In 1940, the fall of the capital signaled to French military and political leaders (as well as most Frenchmen) that the war against Germany was lost.[21] Thus, British efforts to persuade French leaders to abandon Metropolitan France and continue the war from France's colonial empire fell on deaf ears. Only an obscure French brigadier general, Charles de Gaulle, was willing to assume the mantle of continued resistance and continue the struggle against the Germans outside of occupied France.

The failure to take cities may also have powerful unintended consequences. In 1982, the Israelis failed to seize Beirut after their stunning successes in the Bekka Valley, undoubtedly wary of the casualties their forces might suffer in the effort. Instead, they were content to bombard the city by air and artillery from afar. The resulting television coverage on CNN and other networks resulted in a political disaster that seriously affected Israel's relations even with its closest friend, the United States.

Operations in Urban Terrain

Much of the attention of U.S. military circles over the past decade has focused on something entitled urban operations. That term, as suggested in the introduction, conjures up visions of Stalingrad, Manila, Hue, and other nightmarish scenes from the twentieth century. To a great extent, the result has been an either or debate: American military forces will or they will not do cities. In effect, history hangs over the debate like

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[21] For the French reaction to the defeats in May 1940 and their belief that the war was lost with the fall of Paris see P.M.H. Bell, *A Certain Eventuality* (London, 1974); and Eleanor M. Gates, *End of the Affair, The Collapse of the Anglo-French Alliance, 1939-1940* (Berkeley, 1981).

a dark cloud; no matter how ahistorical Americans may be, they do at least understand what Stalingrad meant to the Germans—the burial ground of an army—while memories of Manila, Seoul, and Hue still remain a distinct collective memory in the culture of the U.S. military.

At times there may be no choice in the matter. In coming decades U.S. forces will find themselves committed to fighting in major cities, where the political and strategic issues are over-riding and where the political will demands such commitment. And there should be little doubt that the results will lead to considerable collateral damage and casualties.[22] Both will occur at a level that will bring unpleasant political repercussions no matter how much technology US forces bring to the fight.

But there is another unpleasant reality that history suggests: the problem of urban terrain. The Marines have been quite right to suggest that the urbanization of the landscape across the world has been an increasing phenomena over the past half century. The countryside has been moving to the cities, whether one talks about the third world or the first world. And that fact has major implications for the conduct of military operations, however much first world military organizations, including those of the United States and their leaders, may wish to stay outside of major cities. Moreover, it is difficult to picture where cities end and nonurban zones begin. Where do Lagos, or Karachi, or Bombay, or for that matter Washington DC, actually end? And how will military organizations conduct operations that stop short of the endless urban terrain that surrounds the heart of cities?

But there is another side of the coin and that is the fact that urban terrain is not limited to great cities themselves, but is a reality of the towns, villages, and suburbs across the geographic landscape of human habitation. Midsized towns and villages have exercised as crucial an impact on the conduct of military operations in the twentieth century as the great cities such as Singapore, Stalingrad, Manila, Seoul, Hue, and Beirut. Three examples drawn from the Second World War provide more than ample evidence that urban terrain has been a major factor in the past in the conduct of military operations.

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[22] The level of collateral damage and civilian and military casualties will, of course, depend to a great extent on how well the U.S. Services have prepared their forces to fight in cities.

These three cases are Dieppe, Caen, and the military operations conducted by the US Army in April 1945 across the heartland of Nazi Germany.

Dieppe

In summer 1942 as part of Winston Churchill's policy of harassing the coasts of Nazi occupied Europe, Canadian and British troops carried out a major raid against the small French resort town of Dieppe, which lies on the English Channel. However, this attack was far more than a raid. Instead it was a major military operation, conducted by ground forces that numbered well over a brigade. The objective was to seize and hold Dieppe, while destroying German installations lying in the immediate vicinity, such as the airfield, radar site, and power station.[23] The larger objective, however, was to determine the difficulty the Allies would confront in seizing a port when they sought to establish a permanent foothold on the European Continent.

Dieppe is a narrow coastal town of no great depth, lying at the end of a draw reaching down to the Channel. The town itself fronts on the sea with a two-foot sea wall in front of the beaches. In August 1942 one German infantry regiment of the 302nd Infantry Division defended Dieppe and the heights lying on both sides of the town. The 302nd consisted of third class troops with a strength of under 2,000 men, many of whom were still undergoing basic infantry training.[24] While the defenders possessed some artillery, they had no tanks; the defenses consisted of the town's buildings, although the Germans had blocked off the roads leading from the sea wall into French countryside.

On the Allied side, the Canadians, who attacked the port itself, brought 4,961 men to the fight. They were supported by a number of destroyers and thirty tanks in the first wave. Meanwhile, another 1,000 plus British Commandos and U.S. Rangers assaulted German defensive positions on the flanks.[25] Despite this overwhelming superiority, as well as the fact that Allied troops were all elite, the raid was a catastrophe. The Canadians and their tanks never got off the beaches. The Germans laid down a withering fire from defensive positions in Dieppe's buildings, and, while the tanks got across the sea wall, they got no further. The Royal Regiment of Canada suffered particularly heavy casualties—twenty-

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23 J.R.M. Butler, *Grand Strategy*, vol. 3, part 2, *June 1941-August 1942* (London, 1964), p. 639.

24 Ibid., p. 639.

25 Captain S.W. Roskill, *The War at Sea, 1939-1945*, vol. 2, *The Period of Balance* (London, 1956), p. 243.

six out of twenty-nine officers, and 459 out of 516 soldiers, killed, wounded, or missing.[26] Most of the Canadians had to be abandoned where they had landed, either dead, wounded, or prisoners.

With no special defensive preparations other than those undertaken by defending infantry, the Germans had stopped the attack cold. Obviously the urban terrain and built-up areas of the port had provided the fortified zone necessary to crush a landing by superior forces. The larger point here is that the simple beach front buildings sufficed to prevent the Allied raiding force from getting beyond the town to wreck the facilities, the airfield, and the other targets that the raid aimed to destroy. A few simple beach-front two and three story buildings entirely shut down the possibility of maneuver by the raiding forces and left them in murderously indefensible positions.

In the long run, there was considerable benefit to the Dieppe defeat. The Western Allies drew the crucial lesson that in the upcoming invasion of Europe, "Operation Overlord," they would have to attack across open beaches. *They would not be able to seize any port for the first several weeks of the invasion*—a fact that had important consequences in creating the massive logistical framework of Mulberry Harbors and other over-the-beach supply support that made the invasion successful. After August 1942, no Allied planner could think about the capture of a French port by a direct assault, even though the immediate capture of a port would substantially have eased the logistic difficulties confronting the planning of the Normandy campaign. But Dieppe had underlined that the urban terrain of a port made its capture virtually impossible during the period of the initial landings.

Caen

There has much controversy over the conduct of Allied military operations, once British, Canadian, and American forces established a successful beachhead on the Norman coast in June 1944. But whatever the conception of the ground component commander, General Bernard Law Montgomery, for the coming campaign—whether to use his Commonwealth forces to hold the Germans in eastern Normandy, while the Americans forced the issue in western Normandy, or whether he hoped to break out into the more open terrain to the south and east of Caen and fight the main battle with his Commonwealth troops, while the Americans opened up the French ports—the capture

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[26] Ibid., p. 247.

of Caen was essential to early movement out of the invasion lodgement and to the conduct of further operations.[27]

As the center of the French road network running from Paris to the Channel coast in Normandy, Caen was key to the conduct of the British First Army's ability to fight any sort of a mobile battle against the Germans. Thus, it is not surprising that Montgomery's plans for OVERLORD called for town's capture by the end of the invasion's first day. With Caen in their hands, British forces would have had room to maneuver and support efforts to break out into the open. Unfortunately, British and Canadian troops, under considerable pressure from the moment they landed, did not get to Caen on 6 June 1944. It was not so much the effectiveness of German resistance, but the lethargy of having accomplished the exceedingly difficult task of making a successful lodgment against a tenacious and effective opponent that robbed the British and Canadians of the energy required to push on to Caen. One Canadian battalion had an open road into the town in the late afternoon, but when the battalion commander requested permission to move on his brigade commander denied him permission because it was not in the plan for the Canadians to seize Caen.[28]

That night elements of the 12th SS Panzer Division, *Hitlerjugend,* pushed into and through Caen and immediately set about establishing defensive positions on the town's outskirts. It is worth noting that up to that point, the Germans had undertaken *no* measures to defend Caen against a major Allied assault. Confronted by a series of ferocious counterattacks against the beach head, the British first attempted to encircle Caen from the west. However, a disastrous set back at the hands of German Tiger tanks at Villars Bocage led the British First Army to undertake a series of attacks on Caen to drive the murderous juvenile fanatics of the *Hitlerjugend* out of the town and seize the road network leading to the south and east.[29]

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[27] For the argument that Montgomery was planning to fight the main battle south and east of Caen see Chester Wilmont, *The Struggle for Europe* (New York, 1952).

[28] I am indebted to the Canadian official military historian, William McAndrew, for this story.

[29] For the disastrous destruction of a British armored brigade in the urban terrain of the small French village of Villars Bocage by a single Tiger tank under the command of the German tank ace, Michael Wittman, see: Hastings, *Overlord, D-Day and the Battle for Normandy, 1944*, pp. 132-135.

However, it would take well over a month of intense fighting for Montgomery's troops to drive the Germans out of Caen. By that time heavy Allied air attacks and massive artillery bombardments had turned the town into a rubble-strewn landscape. Not until the CHARNWOOD Operation on 7 July did the British gain the northern half of Caen. While British firepower undoubtedly killed a good many Germans, it probably significantly aided the defending Wehrmacht troops by creating even more obstacles and defensive positions for the advancing British to overcome. One historian describes the results of a great effort by Bomber Command to open the way for the attacking British ground troops in early July in the following terms:

In reality, the devastation wreaked upon the ancient and once beautiful city of Caen did little materially to assist in its capture. Quite the contrary, the bombing in some instances inhibited the progress of some I Corps units attempting to traverse the size of small hills; in places what had once been streets were now gaping holes.[30]

The whole of the city south of the river did not fall completely into British hands until operation GOODWOOD on 18 July. By that time possession of Caen's road network made no difference, since there was nothing left of either the town or the road net. However, had the British captured Caen in the early days of the invasion, they would have been able to put significantly greater pressure on the Germans. Certainly the Germans would not have been able to wage their great defensive battle from the town's wreckage. Caen's road net would have been of great advantage in June, but the very nature of urban terrain reinforced the defensive efforts of the 12th SS Division and its supporting elements. In the end Montgomery had to tackle Caen and its urban terrain because of Normandy's geography and the requirements of his campaign.

Operations in Urban Terrain: Germany 1945

In March 1945, Allied armies closed up on the Rhine as German forces collapsed as a result of their heavy losses in men and equipment suffered in the Battle of the Bulge and subsequent Allied counter attacks. For American and British forces those months of

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[30] Carlo D'Este, *Decision in Normandy* (New York, 1983), pp. 315-317.

January, February, and March involved some of the most intense fighting they engaged in during the course of the military campaigns in the European Theater of Operations (ETO). In January, U.S. forces in the ETO suffered 12,187 battle deaths; in February, 9,008; and in March 13,036—monthly totals that closely replicated the monthly casualties of 1944 from June.[31]

During those months U.S. forces advanced at a relatively slow pace—at least in comparison to the extraordinarily swift breakout of August 1944 from Normandy. German resistance along the West Wall and in the heavily forested and hill terrain of western Germany proved tenacious, skilled, and effective. Only bloody sacrifice opened the way to the Rhineland and the Reich's heartland. But the traditional historical view has been that the grinding battles of fall and winter 1944/1945 finally broke the Wehrmacht's back.

Certainly, the movement of US forces in April seems to support that historical view. To put it simply the armored and motorized infantry of the U.S. Army went on a rampage. The spearheads of the First and Ninth Armies encircled the Ruhr and then drove deep into central Prussia to create a bridgehead over the Oder, where they linked up with the Red Army. Patton's Third Army drove across the Rhine and all the way to the Czech frontier, where it was positioned to capture Prague, before ordered to move south. Similarly troops from the U.S. Sixth Army drove across Bavaria and on into Austria, while the 101st Airborne was able to liberate Göring's wine cellar at Berchtesgaden.

But what appears to be an anomaly in that great, rapid, and in the end decisive campaign is the fact that U.S. casualties dropped hardly at all in April. No less than 10,677 U.S. army soldiers died as a result of combat action in that month in the ETO—over 1,500 more than had died in February.[32] How to account for these high numbers in a month of such victories? To a great extent the answer lies in the losses suffered by American infantry, tankers, artillery men, and engineers in taking the towns and villages, which lay along the roads of western and central Germany. And those villages and towns

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[31] Battle and Nonbattle Deaths, U.S. Army, Statistical Compendium, U.S. Army Military History Institute, Carlisle Barracks, Carlisle, PA.

[32] Ibid.

represented urban terrain as much as any German city in the Ruhr—in fact perhaps more so since by this time in the war Allied bombs had completely flattened most of Germany's major cities. The maintenance of those great advances required that U.S. forces drive out the fanatical wreckage of the Wehrmacht to maintain the supply lines to the rear. And each one of those villages and towns cost the divisions and regiments of the U.S. Army a price in the blood of their men.

The bottom line is that urban terrain is *not* confined to cities. The Wehrmacht may not have retained any mobility by April 1945, and so its troops died in place. But holed up in the towns and villages required to keep the pace of the American drive going, German troops, some of them no more than teenaged boys, extracted a terrible price right through to the end of the month.

Conclusion

The historical record certainly suggests that U.S. ground forces will find themselves engaged in military operations that will involve fighting in urban terrain. In fact, it is likely that cities will lie at the center of U.S. military operations, if for no other reason than they are important politically for our opponents. It is not just that cities will be any bigger or that there will be more of them. Rather it will be that cities will continue to represent the physical geography and battle space that matters. It is there where U.S. military forces will find their opponents.

Even more important is the fact that cities will dominate the geography of the human mind. If Clausewitz is right that war is the continuation of politics by other means, then cities will represent the political goals for which countries will fight throughout the twenty-first century. The American success of 1991 in "Desert Storm" did not lie in the liberation of Kuwati deserts and oil fields, but in the liberation of Kuwait City, for what mattered was the political entity, not blowing sands. One might also note that the very CNN effect so decried by the U.S. military will also affect the decision to go or not to go into cities. In 1945, General Douglas MacArthur committed U.S. troops to driving the Japanese marines out of Manila. As a result, he is often criticized for the resulting terrible casualties that the Filipinos suffered.

What MacArthur's critics of his operations in the Philippines in 1945 often miss is the question of whether the general could have avoided the commitment of U.S. troops, had the Japanese begun to slaughter the Filipinos and American POWs. In the next century, it is simply not going to be a question of stopping on the outskirts of major cities and waiting for matters to sort themselves out. The politics of involvement will inexorably lead the U.S. into the urban terrain of cities, towns, and villages.

Military Operations in Urban Terrain: A Survey of Journal Articles

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Prepared by
Joint Advanced Warfighting Program

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PREFACE

This document, prepared by the Joint Advanced Warfighting Program (JAWP)[1] at the Institute for Defense Analyses (IDA), provides the reader with a brief overview of recent literature on military operations in urban terrain (MOUT). The articles summarized are drawn from selected professional journals between 1995 and 2000. A companion document is planned that surveys books and book-length reports on MOUT.

This document provides an important input to the ongoing work of the Joint Advance Warfighting Program to develop for the Department of Defense a comprehensive road-map for urban operations. This document will be useful to the military or civilian professional working on MOUT issues or the individual in an academic setting beginning research into MOUT. The objective is to provide the reader with the breadth of views recently circulating about urban operations.

The document is extensively cross-referenced. The reader of an electronic copy will find cross-references implemented as hypertext links that facilitate on-line search. The hardcopy reader will have to follow cross-references manually.

[1] The JAWP activity was established at IDA by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP team comprises military personnel from each Service in joint duty assignments and civilian analysts from IDA. The JAWP is located principally in Alexandria, Virginia but includes an office in Norfolk, Virginia that facilitates coordination with US Joint Forces Command. The JAWP fulfills its role as a catalyst by helping to elaborate new concepts and capabilities, conduct joint experiments, integrate related activities, and prepare for implementation.

TABLE OF CONTENTS

ACRONYMS

APC	Armored Personnel Carrier
ARVN	Army of the Republic of Vietnam
BFV	Bradley Fighting Vehicle
CMO	Civil-Military Operations
DRA	Democratic Republic of Afghanistan
GPS	Global Positioning System
HMMWV	High-Mobility, Multi-Purpose Wheeled Vehicle
IDF	Israeli Defense Force
IFV	Infantry Fighting Vehicle
IPB	Intelligence Preparation of the Battlefield (Battlespace)
M113	Armored Personnel Carrier
M1, M1A1	Abrams Main Battle Tank
M2, M3	Bradley Fighting Vehicle, Scout Variant
M551	Sheridan Light Armored Gun System
MACV	Military Assistance Command Vietnam
MLRS	Multiple Launch Rocket System
MOBA	Military Operations in Built-up Areas
MOUT	Military Operations in Urban Terrain
MRT	Mobile React Team
NGO	Non-Governmental Organizations
PGM	Precision-Guided Munitions
PLO	Palestine Liberation Organization
PSYOP	Psychological Operations
PVO	Private Volunteer Organizations
QRF	Quick Response Force
ROE	Rules of Engagement
RPG	Rocket Propelled Grenade
TTP	Tactics, Techniques, and Procedures
UAV	Unmanned Aerial Vehicle
USECT	Understand, Shape, Engage, Consolidate, and Transition
USIPECT	Understand, Shape, Isolate, Penetrate, Exploit, Consolidate, and Transition

SUMMARY

PURPOSE

Urban warfare and military operations in urban terrain (MOUT) have recently received greater attention within the US defense community. Demographics underline the growing urbanization of the world while historical experiences (especially the recent experiences of Russian forces in Chechnya) highlight the complexity of urban operations. This document provides an important input to the ongoing work of the Joint Advanced Warfighting Program to develop for the Department of Defense a comprehensive road-map for urban operations. It provides an overview of the recent literature on urban warfare and MOUT, and summarizes key findings derived from the surveyed literature.

SCOPE

The authors limited their survey to articles that appeared in selected professional and academic journals from 1995 through 2000 listed in Table S-1.

Table S-1. Journals Included in the Literature Survey

Aerospace Power Journal	*Air Force Magazine*	*Airpower Journal*
Armed Forces Journal International	*Armor*	*Army*
Engineer	*Field Artillery*	*Infantry*
INSS Strategic Forum	*Joint Forces Quarterly*	*Marine Corps Gazette*
Military Review	*National Defense*	*Parameters*
Proceedings	*Red Thrust Star*	*Signal*
Soldiers	*U.S. Army Medical Department Journal*	

A considerable literature on urban warfare and MOUT exists in history books, monographs, white papers, doctrine, and other, additional journals and magazines. It is intended that this volume become one in a series of a living documents that survey, abstract, and analyze the literature on urban warfare and MOUT for senior decision-makers, military professionals, defense analysts, and other interested parties.

FINDINGS

Common themes and open issues from the surveyed articles include:

- Current US capability is inadequate for the conduct of urban warfare or military operations in urban terrain, but the need to prepare for combat in urban environments is arguable.
- Current MOUT training facilities are inadequate. The size of the unit trained is too limited and facilities are often oriented on a single branch. Armor, artillery, and aviation fires are typically excluded.
- The nature of operations in urban environments is determined as much by human occupants as by physical structures.
- Inadequate intelligence preparation of an urban environment's human and physical characteristics is a common cause of failure.
- Isolating and dividing areas is a common and successful approach.
- Combined arms teams—including armor, infantry, artillery, aviation, engineers, snipers, and combat service support—form at the lowest tactical levels.
- The roles of aviation and light armor are unsettled. The evidence on their effectiveness is ambiguous.
- The physical environment makes communications problematic. The common need for wide-spread, distributed operations of small tactical units that rely on communications for survival exacerbates the problem.
- Rates of ammunition consumption are higher than in other forms of military operations. This fact strains already difficult and vulnerable logistics capabilities.
- Rules of engagement are critical. They must be simple, dynamic, and tailored to specific situations.
- Military operations in urban terrain will likely be combined, interagency, and joint. Exercises need to be designed accordingly.

THE FRAMEWORK FOR URBAN OPERATIONS

Given the current and anticipated geo-strategic environment, urban warfare and military operations in urban terrain (MOUT) have become significant areas of concern within the US defense community. Historical examples of urban warfare and MOUT—most notably recent Russian experiences in Chechnya, but also experiences dating back to the Second World War, have demonstrated that such operations are typically complex and dangerous. While history has also shown that urban warfare and MOUT may be both difficult to do and impossible to avoid, its lessons may provide current and future warfighters with insights into how to prepare to operate and survive in the urban environment.

This section provides a brief overview of each article surveyed in the document. Article abstracts are presented according to the following scheme.

- ***The Need for and Nature of Military Operations in Urban Terrain***. Entering the city to conduct urban operations is not unanimously seen as necessary among the authors surveyed. Some argue for avoiding cities altogether, while others urge selective application of military force in the city. There is greater consensus that human occupants will drive the nature of operations in the city.
- ***Assessments of Current Preparedness***. Several authors offer articles that assess America's current preparedness for MOUT. These articles are divided between assessments of current operational capabilities and assessments of training and training infrastructure to include facilities and simulations.
- ***Empirical Assessments***. Many of the articles surveyed provide assessments of past military operations in urban terrain based on empirical evidence. These articles tend to look either at methods of force employment or at weapon or weapon system effectiveness.
- ***Evolving Concepts***. New concepts offer improvements to MOUT capabilities. One group of articles proposing new concepts is analytic in nature, based largely on logical argument. A second group describes concepts derived from ongoing experimentation or other developmental efforts.
- ***Civil-Military Operations***. While not explicitly oriented on MOUT, articles are included that bring attention to the civil-military operations that will undoubtedly form a part of operations in built-up and populated areas.

This survey aims to provide interested parties with a quick introduction to recent literature on urban warfare and MOUT. It provides findings but draws no conclusions.

THE NEED FOR AND NATURE OF OPERATING IN URBAN TERRAIN

In "The Indirect Approach," Major General Robert H. Scales, Jr., notes that future foes may look to the capture of urban areas to delay or disrupt the arrival of US forces and diminish their combat effectiveness. Scales contends that the United States could effectively counter this threat by forming a loose cordon around the city and controlling supply and information access. Standoff weapons could attack selected targets to weaken the foe. Scales believes that these actions, which would prompt the civilian population of the city to reject the occupying military forces, would enable victory at a greatly reduced cost. (See [Scales 1998] page 74.)

In "Our Soldiers, Their Cities," author Ralph Peters, a retired US Army lieutenant colonel, contends that urban operations are an unavoidable aspect of future military operations. He further argues that the US military, as currently structured, is grossly unprepared for operating in the urban environment. The article then proceeds to list and describe facets of military operations in urban terrain that need consideration before the US military can operate effectively within the next century's urban environments. Some of the issues discussed include the nature of urban warfare, the organization and equipment of military units, the role of intelligence and civil affairs, and the need for discipline and training. (See page [Peters 2000b] 64.)

In "Urban Warfare: Options, Problems, and the Future" Daryl G. Press looks at the feasibility and likelihood of various types of urban missions. He sees urban policing and raiding missions as likely and doable at a reasonable cost, provided the correct investments are made in doctrine, training and equipment. But he contends that sustained urban combat is both too infrequent and costly to justify the high costs. He argues that US forces should not prepare for sustained urban combat, but instead should employ military and nonmilitary alternatives of a less costly nature. (See [Press 1999] page 67.)

In Brigadier General John R. Groves' "Operations in Urban Environments," the strategic, operational, and tactical implications of MOUT are all underscored. Groves notes that raw military power may not be decisive in urban combat. Understanding the urban environment in all its facets (e.g., geographic, demographic, cultural, historical, political) will be essential, and in fact more important than the force size available. This understanding is required of both military leaders and policy makers. Furthermore, ROE should be carefully constructed with the knowledge that foes will have their own ROE and that political constraints will likely restrict operations more than gaps in military capability. Finally, Groves believes that while there is a common set of tasks associated with MOUT, its complexity requires more than one training template. (See [Groves 1998] page 36.)

Ralph Peters, in "The Human Terrain of Urban Operations," contends that while the physical characteristics of a city are important, the key variable is the population. Peters identifies three types of cities: hierarchical cities, multicultural cities, and tribal cities. In hierarchical cities, chains-of-command operate within a broadly accepted rule of law. Militarily, hierarchical cities, with their united citizenry, can provide bitter and prolonged resistance to an attacker. Paradoxically, they can be the easiest to govern once

occupied—provided the population recognizes its interests lie in collaboration. Multicultural cities are those in which contending systems of custom and belief struggle for dominance. These cities are easier to conquer (with the aid of minorities as a fifth column), but are more difficult to govern once conquered (the fifth column will want preferential treatment). Tribal cities, with their intractable and merciless blood feuds, are the most difficult urban environments for military operations. Peters believes that a cold appreciation of a city's environment and firm resolve often will be of greater help than any technologies or even numbers and that a city's center of gravity is never a building or bridge, it is always human. (See [Peters 2000a] page 61.)

ASSESSMENTS OF CURRENT PREPAREDNESS

Authors providing assessments of current preparedness tended to look either at current operational capabilities or at the state of training programs, training facilities, and other training infrastructure. Abstracts are presented accordingly.

CAPABILITIES

Russell W. Glenn, in "Fox Trot: Seeking Preparedness for Military Urban Operations," examines the positive and negative aspects of the US military's MOUT capability. On the positive side are improvements in Army and Marine Corps MOUT doctrine, and an increasing number of exercises, experiments, and programs dealing with MOUT. On the negative side are too-small MOUT training facilities, nonexistent joint training, poorly constructed rules of engagement, equipment shortfalls for urban-specific tasks, and the lack of a single champion for MOUT in DoD. (See [Glenn 1999] page 28.)

James Kitfield's "War in the Urban Jungles," begins by looking at the two schools of thought on urban warfare: (1) it is too costly to do, and (2) it must be done and so costs must be brought down. He then goes on to review the efforts of the Army, and more so the Marine Corps, to improve capabilities in the urban environment. (See [Kitfield 1998] page 50.)

In "U.S. Unprepared for Urban Warfare, Analysts Caution" Stephen Willingham surveys the opinions on urban warfare expressed at a Special Operations and Low Intensity Conflict symposium. A common opinion in that conference was that the US military could not do much better in urban combat than the Russians did in Chechnya. Specific shortfalls in US urban capability mentioned were: lack of joint training, training facilities that were too small and unrealistic, poor communications, and inability to deal with the increased mental stress on troops. (See [Willingham 1999] page 91.)

In Robert E. Podlesny's article "MOUT: The Show Stopper," the author contrasts the demands of urban combat with the concepts described in *Joint Vision 2010*. The first and most obvious challenge MOUT poses to JV2010 is one of command and control. Given the vertical nature of built-up areas, precision engagement will be problematic given the arcing flight paths of most precision munitions. Dominant maneuver will be difficult in city streets clogged with rubble. Focused logistics will be challenging when units are

scattered about and masses of civilians need assistance. Several steps can be taken to address these issues. First, an operational baseline should be established to design and build future forces. The Joint Staff and CINCs need to develop better analytical and planning tools for MOUT. Junior leader development is critical and needs extra attention. Finally, training areas and MOUT techniques need improvement. (See [Podlesney 1998] page 66.)

TRAINING AND TRAINING INFRASTRUCTURE

The article "Preparing for Today's Battlefield" addresses the likelihood of future urban combat and the way the Marine Corps currently trains for it. Author Lieutenant Colonel Thomas X. Hammes sees Marine Corps training as deficient in quantity and poor in quality. The world's population is shifting into the cities and those cities can not handle the load. This is going to lead to conflict with US troops fighting in those cities. The current 10% of the training spent on urban combat should be increased to 60%. Much of today's training is done at sites that are too sterile and have little in common with the cities of the Third World. Many of the tactics being trained have spilled over from the world of police operations and rescue and are ill-suited to urban combat. (See [Hammes 1997] page 38.)

In "Time to Get Serious About Urban Warfare Training," author Lieutenant Colonel Thomas X. Hammes asserts that the Marine Corps is still doing most of its training in rural settings while proclaiming the future to be about urban combat. He sees four individual skill sets as needing improvement: urban shooting, urban movement, urban communications, and weapons effects. Unit training should include more force-on-force exercises while today's training facilities need to resemble real world cities (e.g., junk cars, trash, and furniture). (See [Hammes 1999] page 39.)

Lieutenant Colonel Jon T. Hoffman's "Marines Assault the Joint Readiness Training Center" looks at Marine participation in exercises at the JRTC. He discusses two lessons learned. One was that, while well-instrumented, the MOUT training facility was too small. The larger units that would have to fight together in war can not train together. The second lesson was that forces operating as small teams can be very effective against conventional forces. The facility's OPFOR operates both a conventional and guerilla "Red" force. The guerilla three- to five-man team does much better than visiting units. (See Hoffman 1999] page 44.)

In "It Takes a Village to Prepare for Urban Combat…and Fort Knox is Getting One," author Robert S. Cameron contends that for the US military to be effective in the urban environment, it must have appropriate facilities to train and prepare for urban operations. He believes that most current MOUT training facilities are deficient in that they focus on dismounted infantry. He then discusses a facility, being built at Fort Knox, that can accommodate heavy armor, allowing attention on the important issue of horizontal and vertical fields of fire for armored vehicles. (See [Cameron 1997] page 23.)

Heike Hasenauer's "F/X for Urban Combat" describes the construction of a MOUT training facility at Fort Knox, Kentucky. The facility will be the first for mounted armor units. The design of the 26-acre, 21-structure complex emphasizes realism. Effects such as simulated machinegun fire, smoke from burning structures, and vehicles on the streets will contribute to the environment. The Armor School will be the primary user of the facility. (See [Hasenauer 1998] page 41.)

Staff Sergeant John Valceanu's "Concrete Combat" describes the activities of the MOUT training facility at Fort Polk Louisiana. Units rotating through the Joint Readiness Training Center can use the complex. The 29-building, seven square kilometer complex puts a strong emphasis on replicating real world environments. Force-on-force, live-fire, and "civilians" all contribute to a high level of realism. (See [Valceanu 1999] page 88.)

In "Simulation Support for the Urban Warrior Advanced Warfighting Experiment," author Major John F. Kelly discusses the simulation support provided the Marine Corps for its *Urban Warrior* exercise. MILES laser and laser detection gear simulated direct fire weapons. GPS units tracked exterior movements, while individual rooms were instrumented to track interior movements. A new JCATS computer simulation modeled effects of indirect fire systems. All of these systems were tied together to give a more realistic training environment. (See [Kelly 2000] page 49).

EMPIRICAL ASSESSMENTS

A significant number of articles found in the journals were empirical assessments of military operations in urban areas. Many were derived from recent Russian experiences in Grozny, but other articles drew lessons from Mogadishu, Lebanon, Vietnam, and World War II. Authors tended to focus either on methods of force employment or on employment of particular weapons, classes of weapons, and other support systems.

ASSESSMENTS OF EMPLOYMENT METHODS

"The Chechen War: Part III," by Lieutenant James Reed, looks at lessons learned by Russia's military from the first Chechen conflict (1994 to 1996). The areas of urban combat, combat reconnaissance, and civil-military affairs were in need of improvement. Russian aviation also performed poorly. (See [Reed 1996] page 71.)

Timothy L. Thomas, "The Battle of Grozny: Deadly Classroom for Urban Combat," identifies some of the major lessons learned from the Russian's first campaign against the Chechens. He cites poor planning, poor training, poor intelligence, and poor communications as contributors to the Russians' debacle in Grozny. He also examines the Chechens' "defenseless defense," in which the Chechens used mobility rather than strong points to thwart the Russians. The most important point may be that there is no "standard urban combat operation." Each is unique to the opponent, the city, specific

operational and tactical issues, geopolitical considerations, and other factors. (See [Thomas 1999] page 84.)

"The Battle for Grozny," by Captain Chad A. Rupe, examines Russian experiences with urban warfare in Grozny. After initial heavy losses, inflicted upon unsupported armor columns in Grozny, the Russians switched to combined arms teams. The two major shortfalls of Russian efforts were intelligence and civil affairs. Their intelligence overlooked the rebels' will to fight and ignored information about rebel tactics, disposition, and composition. They miscalculated the center of gravity of the Chechen revolution to be the leaders in the Presidential Palace rather than the true focal point, Chechen farmers' perceptions of Russian oppression. This anger was further fueled by the special police, who brutalized the populace. (See [Rupe 1999] page 72.)

In "Grozny 2000: Urban Combat Lessons Learned," Timothy L. Thomas examines the Russians' most recent campaign against the Chechens. The level of political support from Moscow for the military was greater. The advance into Grozny was more cautious, and fire support improved. Russian forces also put more effort into ensuring communications security and improving control over the media. Despite changes in tactics and improvements in capabilities, the Russians still had difficulty in discriminating between friend and foe. (See [Thomas 2000] page 86.)

In "'Soft Log' and Concrete Canyons: Russian Urban Combat Logistics in Grozny" Lester W. Grau and Timothy L. Thomas review the Russian logistical effort in the two-month battle for Grozny in 1995. A central point is that urban combat drastically increases ammunition use and logistical requirements. The medical support provided was generally of reasonable quality with the exception of casualty evacuation and sanitation and disease control. A key logistical limitation was the lack of planning time. (See [Grau and Thomas 1999] page 35.)

In "Operation Rio: Taking Back the Streets" William Mendel reviews two urban riot and crime control efforts involving military forces. In 1992 US Army and Marine personnel assisted California National Guard and local police units in quelling large-scale riots. He addresses the difficulties encountered with ROE and leadership. In 1994 to 1995 the Brazilian military conducted Operation Rio to retake control of Rio de Janeiro's ghetto areas from criminal gangs. Mendel cites this operation as an example of what unity of command, good planning, and consideration for the populace can do for mission success. (See [Mendel 1997] page 58).

In "Platoon Under Fire: Mogadishu, October 1993," Captain Mark A.B. Hollis examined some of the problems encountered by elements of the 10th Mountain Division in their role as a quick reaction force in Mogadishu. Their mission was to rescue elements of Task Force Ranger, isolated and under attack after the Somalis shot their Blackhawk down. The limited visibility and thin armor of armored personnel carriers were problematic. The light armor was no match for unsophisticated and common weapons like rocket propelled grenades. With trucks and APCs lacking survivability, mounted infantry became dismounted infantry. Small unit tactics and short range weapons were key to survival. Small units will function independently intentionally or

otherwise. Even the smallest units will form combined arms teams. A small observation helicopter adapted to infantry support, armed primarily with small caliber automatic weapons, showed great utility. (See [Hollis 1998] page 44.)

Captain James D. Leaf, a special forces officer, wrote "MOUT and the 1982 Lebanon Campaign" while attending the armor officer's advanced course. Leaf succinctly captures the essence of three urban operations conducted in 1982 by the Israeli Defense Force in Lebanon. The three urban centers were Tyre, Sidon, and Beirut. The IDF objective was to drive the PLO out of Lebanon and reduce Syria's influence in Lebanon. A single division conducted the effort in Tyre. In Sidon, three divisions participated. Beruit, the largest city, consumed five divisions over three months. The vulnerability of the armored personnel carrier was apparent early and tactics changed accordingly. The operational concept was tailored to the nature of the city and disposition of PLO and Syrian forces. Combined arms teams were a constant, but the supported-supporting relationship shifted frequently between tank and infantry. (See [Leaf 2000] page 56.)

Ali A. Jalali and Lester W. Grau examine the tactics and techniques employed by Afghan guerrillas against Soviet forces in their article "Night Stalkers and the Mean Streets: Afghan Urban Guerrillas." *Mujahideen* successes in cities were due primarily to the popular support and failure of Soviet forces to control rural areas adjacent to the cities. However, despite these successes, the guerrillas encountered many problems and challenges including a lack of communications equipment and securing movement routes through urban areas. Movement security proved manpower intensive. (See [Jalali and Grau 1999] page 47.)

In "Urban Warrior–A View from North Vietnam," Lieutenant Colonel Robert W. Lamont examines the North Vietnamese Army in its 1975 Spring Offensive. The NVA used a technique known as the "blooming lotus," which involved columns bypassing defenses on the perimeter of cities and penetrating directly into the interior. C^2 nodes would next be attacked and eliminated. Only then would NVA forces attack outward to dispatch the now disorganized and leaderless units on the perimeter. This tactic worked because of two key actions by northern troops. Intelligence preparation took the form of tapping into extensive HUMINT assets in the cities to discover the location of perimeter defenses and C^2 nodes. Just prior to the attack, sapper units would infiltrate into the cities to seize bridges and road junctures. This facilitated rapid movement of sufficient combat power into the city center to attack C^2 nodes. Only by blending the human side of intelligence with technologically improved systems can a commander hope to identify centers of gravity. (See [Lamont 1999a] page 53.)

ASSESSMENTS OF WEAPONS AND WEAPON SYSTEMS

Lester W. Grau, in "The RPG-7 on the Battlefields of Today and Tomorrow," notes that when combatants are ten to thirty meters apart, artillery and air support is practically nonexistent due to the danger of fratricide. Constricted terrain (mountains, forest, jungle, and cities) leads to a type of direct-fire brawl in which weapons like the RPG-7 excel.

Grau describes some of the tactics used by various RPG-equipped forces. Examples come from Angola, Somalia, Afghanistan, and Chechnya. (See [Grau 1997] page 33.)

Lieutenant Colonel Robert W. Lamont's "Tale of Two Cities–Hue and Khorramshahr" argues that while the number of armored vehicles needed for urban fighting is less, their contribution to the fight is greater. At Hue, M-48 tanks (with ammunition expenditure rates 30% higher than normal) assisted pinned-down infantry on many occasions with their 90 mm cannon fire. Furthermore, the M-48s also opened up safer evacuation routes for casualties by knocking down walls and obstacles. They could also force defenders to ground making, thus making subsequent Marine infantry assaults easier. At Khorramshahr (Iran-Iraq War 1980), the Iranian defenders constantly generated local tactical threats because they had armor. In spite of being outnumbered 2.5 to 1, Iranian armor stopped Iraqi attacks in urban areas. Only repeated combined arms assaults could defeat the Iranian tanks. (See [Lamont 1999b] page 54.)

In "Russian-Manufactured Armored Vehicle Vulnerability in Urban Combat: The Chechnya Experience," author Lester W. Grau describes how Russian forces lost 10% of their armored vehicles in Chechnya. Important insights were that most destroyed vehicles sustained an average of three to six lethal hits, fuel cells and engines being favorite Chechen aim points. Most of the tanks destroyed in the first month suffered hits in areas not protected by reactive armor. Furthermore, Russian tank guns were incapable of elevating or depressing sufficiently to engage Chechen forces on upper floors or in basements. Grau notes that attachment to armored columns of anti-aircraft artillery systems and dismounted infantry reduced Russian losses. (See [Grau 1997] page 32.)

Jim Warford's "The Resurrection of Russian Armor: Surprises from Siberia" examines a new heavy APC demonstrated at an arms exhibition in Siberia. The BTR-T is based on the old T-55 tank. It uses a T-55 hull, minus its turret, with a mini-turret mounting a 30 mm cannon. The idea for the vehicle came from experience in Grozny. The vehicle provides a higher level of protection to mounted troops. This new type of vehicle resembles the heavy APC developed by the Israelis. After the urban fighting in Lebanon in 1982 the Israelis found their M113 APCs woefully inadequate for MOUT. They then developed the Achzarit heavy APC (put into production in 1988). Like its Russian cousin, it too is based on the T-55. Armor protection was made the highest priority; the weight of the armor protection alone is reportedly 14 tons. (See [Warford 1999] page 88.)

Captain James B. Daniels, in "Mechanized Forces in MOUT: M113 Lessons from *Operation Just Cause*," contends that the leaders of mechanized units must think of MOUT as a realistic contingency and train accordingly. Using *Operation Just Cause* as an example, he notes that the primary asset of armor in the city is its speed—M113s could often move through potential choke points before PDF forces could set up roadblocks. He also noted that while rules of engagement strictly limited the use of air support and artillery, the .50 caliber machine guns on M113s were much less risky of causing collateral damage. M113s also functioned well as mobile combat service support assets

carrying ammunition and supplies for establishing roadblocks. (See [Daniels 1996] page 25.)

Major Gregory J. Celestan reviews artillery use in the first Chechen conflict in "Red Storm: The Russian Artillery in Chechnya." With global trends in urbanization, the lessons learned by the Russians in Chechnya are valuable to any military. One lesson the Russians appear to have learned is one cannot preplan most artillery fires, which is counter to Russian/Soviet tradition. They also learned that smaller units work better. Russian artillery changed from being a supporting tool to being a major means, direct fire missions becoming the norm. Chechen forces still managed to take advantage of slow response times by conducting hit-and-run artillery raids. (See [Clesetan 1997] page 24.)

Major Harry J. Hewson's "Light/Attack Helicopter Operations in the Three Block War" explores the role that Marine light and attack helicopters can play in MOUT. Helicopters can provide situational awareness, rapid mobility in the city, and accurate firepower on enemy units close to friendly forces. Some within the Marine Corps believe rotary-wing aircraft are not survivable in the city, but evidence suggests (from Chechnya and Somalia) that with proper tactics they can survive. The development of those tactics is hampered by the lack of live-fire MOUT training facilities for aircraft. (See [Hewson 1999] page 43.)

In "Air Operations in Low Intensity Conflict: The Case of Chechnya," author Timothy L. Thomas examines air power's limited effectiveness in low intensity conflict. Specifically, he examines the Russian employment of air assets against the Chechens and uses those experiences in considering the relative merits of rotary wing and fixed wing aircraft. Thomas describes the Russian air campaign against the Chechens, which some have criticized as being rather crude (e.g., focused on the unsophisticated Chechen air force as opposed to command and controls nodes, etc.). In the final analysis, Thomas notes that fixed wing aircraft, more robust and durable, seemed better suited to the nature of low intensity conflicts. (See [Thomas 1997] page 82.)

In "Changing Russian Urban Tactics: The Aftermath of the Battle for Grozny," author Lester W. Grau notes that Soviet military doctrine had been to bypass defended cities. The assumption was that a professional foe would not risk its own cities by fighting in them. That assumption ill-prepared the Russians for MOUT in Grozny. Russian errors included: failure to cut off the city, poor planning, and weak intelligence preparation. The usage rates of some munitions (high explosive grenades, smoke grenades, demolition charges, light anti-tank weapons) were much higher than expected. Snipers were useful but in short supply. Artillery worked best in the direct-fire mode and used a high proportion of smoke rounds. Fixed-wing aviation was of limited value while helicopter gunships were effective. (See [Grau 1995] page 29.)

Lester W. Grau takes a look at the problems of urban communications from a Russian view in "Urban Warfare Communications: A Contemporary Russian View." He addresses the problems Russian forces encountered in Grozny: radio interference, frequency limitations, the problems of wire links, and communications security. The

author provides a list of solutions based on what would be feasible for today's Russian military. (See [Grau 1996] page 31.)

In "Handling the Wounded in a Counter-Guerrilla War: The Soviet/Russian Experience in Afghanistan and Chechnya," authors Lester Grau and Dr. William A. Jorgensen examine the Soviet/Russian military medicine experience. They address issues of wounded-to-killed ratio, types of wounds, medical transport, and facilities location. (See [Grau and Jorgensen 1998] page 34.)

EVOLVING CONCEPTS

Several authors proposed new concepts or reported on concepts evolving from experimentation or other developmental activities. Article abstracts below are based on the apparent source of the concept. Articles in the first group are analytic or philosophical in nature, relying primarily on logical argument. Articles in the second group describe concepts derived from experimentation or that are in some phase of development.

ANALYTICAL

Lieutenant Commander Charles J. Gbur, Jr., discusses the potentially high casualty rates and unique threat environment of MOUT in "Battalion Aid Station Support of Military Operations on Urbanized Terrain." He believes that MOUT will require changes in the way battalion aid stations do business. Medical personnel will require improved training in the sniper threat, casualty location, extraction of casualties pinned under rubble, urban communications, and working with local civilian medical personnel. Some form of armored ambulance/intensive care unit will be required. Higher levels of care will be required prior to evacuation, given the likely scarcity of helicopter landing zones. Finally, the battalion aid stations will need full C^4I integration capability. (See [Gbur 1999] page 27.)

Lieutenant Ethan H. Harding posits in his article "Urban Tank Employment Proposal for the 21st Century" that the Marine Corps tank community needs to establish better tactics, techniques, and procedures for MOUT. He proposes the creation of mobile react teams (MRT) comprised of one tank section, supported by an infantry squad and an engineering team mounted on two assault amphibious vehicles. The MRT would stay two to three blocks behind advancing infantry when functioning as an on-call assault gun. The MRT could also operate as a manned roadblock or sortie out from a compound. To develop and refine this capability, Harding believes that combined infantry and tank training should be an annual requirement, and the Marine Corps needs a larger MOUT training facility for realistic training. (See [Harding 1999] page 40.)

Dennis Herbert's "Non-Lethal Weaponry: From Tactical to Strategic Applications" examines the growing relevance and effectiveness of non-lethal technologies in military operations. He notes that as tactical events have increasingly strategic implications, non-lethal weapons provide warfighters with a means to perform their mission without

jeopardizing national security objectives and interests. Herbert believes that a coherent non-lethal weapons development and acquisition cycle will enable the creation of a family of non-lethal weapons useful at the tactical, operational, and strategic levels. He concludes with a warning that there are still many legal, ethical, and environmental aspects of non-lethal weapons that need resolution before widespread employment. (See [Herbert 1999] page 41.)

Captain O. Kent Strader contends that soldiers will have to be more aware of their surroundings in his article "Counterinsurgency in an Urban Environment." This awareness begins with intelligence collection. Strader believes that intelligence lies at the heart of counterinsurgency operations. Patrolling should focus on gathering intelligence and establishing good will with the local population. Additionally, snipers may be used for intelligence collection and for "surgical" kills on targets of opportunity. Strader also contends that the lack of a clear front line will require combat service support elements to improve their combat skills and incorporation of armored vehicles and helicopters is an essential psychological tool in defeating an enemy in MOUT. (See [Strader 1997] page 80.)

Captain J. P. Klug urges his armor colleagues to think hard about their contributions to urban combat in "Armor's Role in Future US MOUT Doctrine: Facing Up to the Urban Fight." Klug begins with a quick survey of four important documents that identify urban operations as important targets for training and doctrine development. He then identifies several publications under revision and more that need revision. Klug theorizes that an Army medium weight brigade could augment a Marine Expeditionary Unit already in theater and suggests the need for close Army-Marine Corps cooperation in MOUT training and doctrine development. He speculates that medium brigades might find use in three additional scenarios. "First, they may have to defend an urban center of gravity from a hostile force. Second, they may have to attack a rogue government's forces located in an urban area and reestablish a previous legitimate government. Third, they may have to isolate a large urban area and then wait for additional forces to move into theater and conduct offensive operations." He argues for unmanned aerial vehicles and precision guided munitions and devotes considerable attention to the importance of combat support and combat service support, specifically the central role of combat and construction engineers. (See [Klug 2000] page 51.)

Captain Scott E. Packard's "Bottom Line: It's Infantry" looks at the role of infantry in urban OOTW. He sees the current doctrinal emphasis on combined arms as unworkable in the city. A large slice of future operations will be urban OOTW and infantry will play the major role in that environment. Many of today's US military capabilities just will not work in the city, including most of the US high-tech intelligence collection systems. He sees the need for a continual infantry presence on the ground, interacting with the locals, respecting their concerns, and tapping into the HUMINT potential of the local populace. By adopting a more flexible command structure and using dispersed dismounted infantry, US forces can do the urban OOTW mission successfully. (See [Packard 1998] page 61.)

"MOOTW: Fighting the Close Quarter Battle," by Captain Stephen J. Greene, addresses current doctrine for clearing buildings and its inadequacy for military operations other than war. Current doctrine relies on brute force (e.g., a grenade in every room) that is not practical when operating under the strict rules of engagement associated with humanitarian operations. The answer lies in training to a new Enhanced MOUT standard. Enhanced MOUT relies on discriminate and accurate shooting using the standard M16A2 rifle. (See [Greene 1996] page 36.)

"Don't Go Downtown Without Us" authors Lieutenant General Norton A. Schwartz and Colonel Robert B. Stephan look at the role of aerospace power in urban operations. The classic view of urban operations is that they circumvent much of the US technology advantage and involve manpower intensive house-to-house fighting. This is disputed by the authors. While some conflicts will require substantial ground forces, a large swath of the conflict spectrum will not. They see cities as consisting of critical nodes vulnerable to air attack. They then lay out a five part hypothetical concept of operations in which aerospace power can play a major role. (See [Schwartz and Stephan 2000] page 75.)

EXPERIMENTAL

In "The Foundation for Urban Warrior," Colonel Randolph A. Gangle reviews urban warfare history to reveal several common features. In the past attackers typically surrounded the city and conducted a methodical, linear sweep. That sweep generated numerous friendly, enemy, and civilian casualties, while using large quantities of small arms ammunition and grenades. Combat in the city was extremely taxing on the troops both mentally and physically. Gangle then discusses the efforts of the Marine Corps Warfighting Lab to develop several new concepts for dispersed forces in the urban environment. *Urban Penetration* has units move quickly (often with stealth) along multiple axes against a specific unit or location. *Urban Thrust* involves assaults along narrow axes of advance. *Urban Swarm* uses dispersed units to quickly respond from their assigned sectors to other areas requiring assistance. *Active Defense* uses a thin screen of forces backed up by a mobile reserve. (See [Gangle 1998] page 26.)

F.V. Reed's article "City Slickers Become Targets of Future Marine Corps Operations" looks at *Urban Warrior*. This Marine Corps series of battle experiments focused on testing tactics and technology for urban combat. Laboratory officials see decentralized operations as an important element in doing the urban mission with fewer casualties than has been traditional. Commercial radio equipment offers considerable potential for inexpensive communications between small unit leaders. Several new weapons concepts are also being explored. (See [Reed 1998] page 69.)

Captains John L. Miles, III, and Mark E. Shankle consider the use of armored personnel carriers in urban areas in "Bradleys in the City." While preparing for deployment to a MOUT training facility in Germany, the authors found little published material on employing Bradleys in urban terrain. The authors conclude that the firepower of the Bradley could enable the effective isolation and suppression of selected buildings. However, they also noted that firing 25 mm discarding sabot ammunition endangered

friendly dismounted troops to the front of the gun. (See [Miles and Shankle 1996] page 58.)

"Engineers, Army After Next, and Military Operations in Urban Terrain," by Jeb Stewart, looks at the role of engineers in the Army After Next and urban combat. During Army After Next war games the enemy often retreated into the city to avoid US firepower. Combat inside of those cities would have required many of the functions that engineers have traditionally conducted: rubble clearing, wall breaching, demolition, and infrastructure repair. New technologies offer the prospects of engineers expanding their role in MOUT. Stewart concludes by reviewing engineering lessons learned from urban operations in Panama (1989). (See [Stewart 1999] page 79.)

Major Kevin W. Brown's "The Sustainment Distribution Team—Providing 'Close' Combat Service Support in MOUT" describes a concept that has come out of Marine Corps experimentation—a sustainment distribution team consisting of eleven to thirteen Marines in two MV-22 transportable vehicles. The primary mission of the team is to provide immediate resupply and casualty evacuations to combat units. This type of organization would enable combat units to maintain focus and momentum in urban operations. Furthermore, unlike experimenting with technology-driven solutions, the organizational driven SDT concept is relatively inexpensive. (See [Brown 1998] page 22.)

In "The Urban Warfare Dilemma – U.S. Casualties vs. Collateral Damage" Captain Kevin W. Brown examines the contrasting goals of low US casualties and low collateral damage in urban operations. The lessons of Manila (1945), Seoul (1950), and Hue City (1968) all point to restrictive rules of engagement being relaxed as soon as friendly casualties began to mount. He then looks at three initiatives designed to improve US MOUT capabilities; the MOUT ACTD, the J-8 MOUT Seminar Wargame, and the Marine Corps Urban Warrior effort. (See [Brown 1997] page 21.)

Dennis Steele's "Mounting Siege on Urban Warfare: Creating Technology for Kicking in the Door," describes the activities at an Army MOUT training facility. The exercises were part of the MOUT Advanced Concept Technology Demonstration program. Most of the equipment used was at the lower end of the technology scale. (See [Steele 2000] page 78.)

In "Marines Seek New Solutions to Secure the Urban Arena," author Fred V. Reed looks at the Marine Corps *Urban Warrior* exercise. He surveys a wide range of high-tech and low-tech solutions to urban combat problems. Off-the-shelf commercial hardware can reduce cost and speed acquisition, and simulation can improve realism. Improved situational awareness offers a clear path to reduce friendly fire incidents. (See [Reed 1999] page 67.)

Stephen Willingham looks at Marine Corps MOUT efforts in "Marine Technology Dollars to Focus on Urban Combat." The author attended an exposition displaying potential future equipment for the Marines manufactured by various defense manufacturers. Comments on the displays were gathered from some of the attending

military personnel. The Marine Corps is also looking to speed up the acquisition process by purchasing off-the-shelf commercial equipment. (See [Willingham 1999] page 90.)

CIVIL-MILITARY OPERATIONS

Colonel John J. Tuozzolo, in his article "The Challenge of Civil-Military Operations," discusses the complex role of military organizations in peacekeeping and peacemaking missions. He notes that, while military units perform the usual stability, security, and freedom of movement duties, they sometimes have new and unique missions to perform. In order to succeed, they must often work with civilian agencies to accomplish the overall mission of the civilian-military force. To accomplish this, military personnel must become more involved in the civilian process than originally envisioned. (See [Tuozzolo 1997] page 87.)

Lieutenant Colonel Michael M. Smith's and Major Melinda Hofstetter's "Conduit or Cul-de-Sac? Information Flow in Civil-Military Operations" examines the role of intelligence and information within the context of civil-military operations. The authors note that military units and NGOs tend to coordinate poorly because of misperceptions and mistrust—despite the fact that the goals of NGOs and the military often overlap. The authors believe that relief workers can provide excellent human intelligence and the sharing of intelligence (even with minimal reciprocity) can be a benefit in and of itself. The authors believe that civil-military coordination is often easier when it is informal and conducted at lower levels. (See [Smith and Hofstetter 1999] page 77.)

COMMON THEMES AND OPEN ISSUES

The introductory chapter provided abstracts based on their principal subject area and analytic orientation. This chapter looks across the entire set of articles for common themes and unresolved issues.

THE NEED TO PREPARE FOR URBAN OPERATIONS IS ARGUABLE

Views on the need to prepare for military operations in urban terrain range from isolate and bypass (see [Scales 1998] page 74) to acceptance as ineluctable (see [Peters 2000b] page 63). In between these extremes are views that it is better to prepare for only certain operations, including policing operations and raids, while avoiding sustained combat (see [Press 1999] page 67). Another article advocates a concept of operation that emphasizes precision attack and the dominant role of aerospace power (see [Schwartz and Stephan 2000] page 75).

MOUT TRAINING FACILITIES ARE INADEQUATE

Current MOUT training facilities are inadequate because they: do not allow for battalion-size exercises, do not allow live fire armor employment, and do not allow live fire air support (see [Cameron 1997] page 23, [Glenn 1999] page 28, [Harding 1999] page 40, [Hasenauer 1998] page 41, [Hewson 1999] page 43, and [Podlesny 1998] page 66).

HUMAN INHABITANTS ARE A KEY COMPONENT OF URBAN TERRAIN

A common theme is that the dominant characteristic of any urban environment is the nature of the people(s) who live there (see [Peters 2000a] page 63 and [Groves 1998] page 37). Several articles, including historical studies, cite failures of intelligence preparation to fully understand the human aspects and identify the true center of gravity (see [Groves 1998] page 36, [Jalali and Grau 1999] page 47, [Mendel 1997] page 58, [Peters 2000a] page 63, [Peters 2000b] page 64, [Rupe 1999] page 72, [Scales 1998] page 74).

INTELLIGENCE PREPARATION IS DIFFERENT BUT EQUALLY CRITICAL

Intelligence preparation is as relevant in urban environments as it is in open field warfare. However, because of the extensive manmade terrain and the significant presence of non-combatants, intelligence collectors and processes appropriate to warfare in natural

terrain are often inadequate to the task. Comprehensive and in depth intelligence preparation is essential for successful urban operations (see [Grau 1995] page 29, [Groves 1998] page 36, [Lamont 1999a] page 53, [Peters 2000b] page 64, [Podlesny 1998] page 66, [Rupe 1999] page 72, [Smith and Hofstetter 1999] page 77, [Strader 1997] page 80, and [Thomas 1999] page 86). Human intelligence is a major portion of any intelligence gathering effort in the urban environment (see [Lamont 1999b] page 54, [Mendel 1997] page 58, [Smith and Hofstetter 1999] page 77, [Thomas 1999] page 84).

ISOLATION AND DIVISION ARE COMMON TO SUCCESSFUL OPERATIONS

The ability to isolate a city is a common component of military operations in urban environments, even for those who favor bypassing cities altogether (see [Scales 1998] page 74). Furthermore, the ability to divide a city into areas and then to isolate those areas is also a common component of successful operations (see [Grau 1995] page 29 and [Mendel 1997] page 58).

COMBINED ARMS OCCURS AT THE LOWEST TACTICAL LEVELS

Many articles present conclusions derived from empirical examinations of urban operations. Authors uniformly conclude that successful urban combat operations depend on combined arms operations, and that combined arms teams form at the lowest tactical echelons. The high utility of armor, when used closely with infantry, is a common theme (see [Cameron 1997] page 23, [Daniels 1996] page 25, [Grau 1997] page 32, [Grau 1998] page 33, [Harding 1999] page 40, [Lamont 1999a] page 53, [Rupe 1999] page 72, and [Strader 1997] page 80). The lack of a clearly defined front line requires armored vehicles for the combat service support elements of the force as well as for the combat elements (see [Daniels 1996] page 25, [Gbur 1999] page 27, [Grau and Thomas] page 35, and [Strader 1997] page 80). In addition, snipers make an important contribution to the combined arms team (see [Grau 1995] page 29, [Grau and Thomas] page 35, [Strader 1997] page 80, [Thomas 1999] page 86). Finally, attack helicopters can provide effective support to ground forces when properly employed (see [Grau 1995] page 29, [Hewson 1999] page 43, [Hollis 1998] page 45, and [Strader 1997] page 80).

Those articles not principally based on empirical evidence do not necessarily share the combined arms view but, rather, often propose service or branch specific solutions (see [Miles and Shankle 1996] page 60 and [Schwartz and Stephan 2000] page 75).

THE ROLE OF AVIATION IS UNCERTAIN

The literature indicates that attack helicopters can prove useful in the urban environment, if properly employed (see [Grau 1995] page 29, [Hewson 1999] page 43, and [Strader 1997] page 80). One author argues that rotary-wing aircraft are too vulnerable to ground fire and that slow flying fixed-wing aircraft are better suited to the urban environment (see [Thomas 1997] page 82). Other authors argue for the use of aircraft in the precision strike role (see [Schwartz and Stephan 2000] page 75).

THE ROLE OF LIGHT ARMOR IS UNCERTAIN

Conclusions on armored and mechanized forces were mixed, especially with respect to light armored vehicles. In some cases, the lightly armored, tracked vehicles simply were not survivable (see [Hollis 1998] page 45 and [Warford 1999] page 89). In other cases, the shock value of their speed and mass was sufficient to deter aggression (see [Strader 1997] page 80 and [Daniels 1996] page 25). One article describes a training event employing a company of light armored vehicles (Bradleys) without mention of their vulnerability or their limited combined arms capability (see [Miles and Shankle 1996] page 60).

COMMUNICATIONS ARE PROBLEMATIC

Communications in the urban environment is more difficult *and* more important. The concrete and steel structures in the city impose limits on simple man-portable radios that do not occur in open terrain. The vertical nature of cities imposes additional restrictions on line-of-sight communications equipment. To compound the technical problems, small tactical units that can communicate with voice and hand signals in open terrain must break into smaller units that operate more independently. Thus, the requirements to communicate increase and the ability to communicate decreases. See [Grau 1995] page 29, [Hollis 1998] page 45, and [Strader 1997] page 80).

AMMUNITION USE RATES ARE HIGH

Overall ammunition use rates are higher in urban combat, particularly small arms, grenades, and smoke rounds for artillery (see [Brown 1998] page 21, [Gangle 1998] page 26, [Grau 1995] page 29, [Grau and Thomas] page 35, and [Lamont 1999b] page 54).

TACTICAL RULES OF ENGAGEMENT ARE KEY

Rules of engagement have been critical in past urban scenarios and will continue to be in the future. Rules of engagement are an important method of implementing political desires by limiting the use of military force. Therefore, in planning and exercises, a number of authors argue that attention should focus on the effects of rules of engagement on military operations and the political dynamics behind their creation (see [Glenn 1999] page 28 and [Groves 1998] page 36).

JOINT, INTERAGENCY, AND COMBINED ISSUES

Joint, interagency, and international coordination are critical and deserve attention in MOUT exercises (see [Hollis 1998] page 45, [Mendel 1997] page 58, [Thomas 1999] page 84, and [Tuozzolo 1997] page 87).

ABSTRACTS

THE URBAN WARFARE DILEMMA – U.S. CASUALTIES VS. COLLATERAL DAMAGE

Brown, K.W.
"The Urban Warfare Dilemma – U.S. Casualties vs. Collateral Damage"
Marine Corps Gazette
January 1997
Pages 38-40.

This article looks at the difficulty in keeping both casualties and collateral damage low in the most challenging type of urban combat; an offensive against well-prepared and capable enemies. History suggests that US forces are incapable of keeping both casualties and collateral damage low. The pattern was the same whether in Manila in 1945, Seoul in 1950, or Hue City in 1968. US forces would begin operations with restrictive rules of engagement (ROE). But once friendly casualties mounted the ROE were substantially relaxed. In an increasingly urbanized and publicized world, military operations in urban terrain will likely be the most significant challenge facing the Corps in the 21st century.

The article then lists several initiatives planned at the time of its writing. The first was the MOUT advanced concept technology demonstration (ACTD). The focus of this joint Army/Marine Corps program was to accelerate development of technologies that could improve urban capabilities in the following areas:

- The identification of combatants/noncombatants and friend/foe,
- a lightweight, armored vehicle capable of precision fire,
- non-lethal weapons for counter personnel and counter vehicle duties, and
- point munitions for infantry to defeat armored vehicles and breach walls.

A second initiative was the J-8 sponsored MOUT Seminar Wargame. That wargame explored the integration of advanced concepts, capabilities, and technologies in a major urban campaign. The third initiative was the Marine Corps *Urban Warrior*, the second phase of the Sea Dragon ACTD. *Urban Warrior* will draw upon the success of *Hunter Warrior* and focus on experimenting with potential solutions to challenges identified from a variety of sources.

THE SUSTAINMENT DISTRIBUTION TEAM – PROVIDING "CLOSE" COMBAT SERVICE SUPPORT IN MOUT

Brown, K.W.
"The Sustainment Distribution Team –
Providing "Close" Combat Service Support in MOUT"
Marine Corps Gazette
November 1998
Pages 72-73.

In this article, Major K.W. Brown, a Marine Corps logistics officer, describes a new combat service support concept that has come out of Marine Corps combat service support experimentation. The sustainment distribution team concept focuses on the urban combat problems of casualty evacuation and resupply for isolated units operating in the city's heart. As envisioned, when the article was written, the sustainment distribution team would be a small element of eleven to thirteen Marines accompanied by one or two MV-22 transportable vehicles. The sustainment distribution team would augment an infantry platoon and have the tasking of immediate resupply and casualty treatment and evacuation. An important secondary mission of the sustainment distribution team is to provide additional combat power to the platoon.

Unlike many technology-driven initiatives, the organization-based sustainment distribution team concept is relatively inexpensive for experimentation. During the April 1998 Limited Objective Experiment (LOE) 2 the sustainment distribution team concept was heralded as a resounding success. Without the sustainment distribution team, augmentation of the infantry unit would have been paralyzed with ammunition shortfalls and casualty buildups.

IT TAKES A VILLAGE TO PREPARE FOR URBAN COMBAT… AND FORT KNOX IS GETTING ONE

Cameron, R.
"It Takes a Village to Train for Urban Combat…and Fort Knox is Getting One"
Armor
November-December, 1997
Pages 9, 12.

Robert S. Cameron, Ph.D., Fort Knox Historian, describes a developing facility at Fort Knox, KY, home of the Army's Armor School. The facility will support training, experimentation, and doctrine development for heavy forces in urban environments.

The author begins by recounting the experience of the Israeli Defense Force in Lebanon. The IDF's initial entry into Lebanon was swift and convincing. The PLO withdrew into the cities where it reduced the IDF advantage and enhanced its own decentralized tactical command and low-technology weapons. The IDF response was to direct artillery and air power to still populated cities and the result was international condemnation. The IDF's second response was to use infantry operations that brought high casualties and an erosion of political support in Israel. Armor-supported infantry is offered as the obvious middle ground.

Most Army MOUT training facilities are oriented on infantry and thus, are not suitable for tank or mechanized operations. The Fort Knox facility addresses that shortcoming. The MOUT cite, with a staff of thirteen, covers 26 acres. It will contain a variety of structures, including school, communications center, open air market, embassy, cemetery, airfield, gas station, train tracks, houses, bridge, sewer system, businesses and an industrial area. The facility will be littered with debris and burnt-out vehicles. Much will be done to stimulate the senses, including sight, sound, and smell. The range is capable of supporting from squad to battalion task force operations, and is instrumented with MILES and TWGSS/PGS equipment.

RED STORM: THE RUSSIAN ARTILLERY IN CHECHNYA

Celestan, G.J.
"Red Storm: The Russian Artillery in Chechnya"
Field Artillery
January-February 1997
Pages 42-45.

Major C.J. Celestan, an analyst at the Army's Foreign Military Studies Office, sees the lessons learned by the Russian military in Chechnya as relevant to many armies because of the changing nature of warfare. In future conflicts, increasing urbanization will guarantee the use of artillery in close proximity to civilians. Urban combat is extremely manpower intensive and no military force today has a workable doctrine.

Several articles in Russian military publications have addressed the use of artillery in Chechen cities. A common theme was that the quantity of fire support needed was situational dependent and could not be preplanned. This was a sharp departure from traditional Russian fire planning.

Another departure from standard Soviet doctrine was unit size. Soviet doctrine had designated the artillery battalion as the smallest tactical unit needed for effective employment. In Chechnya, larger armor formations were broken up and assigned small detachments of artillery. Direct fire became the approved method for destroying strongpoints, often at 150 to 200m meters. This use of smaller artillery units mirrors the tactics used by Soviet forces storming Berlin in 1945.

As in the past, Russian artillery destroyed the bulk of the targets. A major difference in Chechnya was that artillery was a means unto itself rather than as a part of a combined arms team. A common operation had artillery and aviation bombard a target for several hours until the local commander felt all resistance had been destroyed. Then a mounted patrol would approach the target, calling in more artillery, if there was any resistance. In general, the Russians were happy with their mobile rocket launch systems (122 mm Grad and 220 mm Uragan). Their shock value and ability to destroy large areas with one volley suited Russian tactics. The Russians possessed several precision artillery rounds for their guns and mortars, but the higher command thought they should not be "wasted" in Chechnya.

Chechen tactics took advantage of the Russian preference for preplanned artillery strikes. The Chechens would organize hit-and-run attacks with their own guns and rocket launchers. The Russian would have difficulty reacting with their own strikes before the Chechens dispersed. Russian forces had counter-battery radar that should have allowed for more accurate counter-battery strikes. But poor training and hastily composed units prevented the development of the skills to use that capability effectively.

MECHANIZED FORCES IN MOUT

Daniels, J.B.
"Mechanized Forces in MOUT"
Infantry
May-June, 1996
Pages 8-11.

"Mechanized Forces in MOUT" documents lessons from a mechanized infantry task force employed in *Operation Just Cause*. The units discussed were combined arms teams, tasked organized for their missions in Panama, with ample time to familiarize themselves with the environment.

Initially, the task force consited of two rifle companies with M113A2 armored personnel carriers plus headquarters and slice elements from battalion. Four months later they were replaced by the 4th Battalion, 6th Infantry with four rifle companies, battalion headquarters and headquarters company, and an anti-armor platoon of improved TOW vehicles. The task force arrived approximately four months before *Just Cause* began.

The mere presence of the M113s was important, and they stayed visible throughout their deployment. The M113 purchased a certain amount of shock value with forces not accustomed to mechanized vehicles. Initially, the rifle companies were designated as quick reaction forces, QRF 1 through 4, with 15 minutes, 1 hour, 2 hours, and 4 hours reaction time, respectively. Companies rotated stations every few days and conducted company movements to be visible, to observe PDF reactions, and to desensitize the local population. Movements occurred without rounds and magazines loaded to show lack of hostile intent. Movement was at 15 MPH at 10 meter spacing, ignoring traffic signals. M113s, HMMWVs, and 2 ½-ton trucks were used for combat service support.

During the invasion, companies quickly sealed off intersections. The .50 caliber machine gun provided suppressive fire. One platoon suffered several casualties in night sniper attacks, and the M113 evacuated casualties. After the invasion, the battalion conducted mounted and dismounted patrols to maintain order and locate hostile forces. It also ringed the compound where Noriega had claimed sanctuary.

The M113 could move over most roads but not side streets and alleys. Dismounted infantry played a key role in house-to-house searches. The higher troop carrying capacity of the M113 over the M2 Bradley was advantageous. In a CSS role, the M113 could carry a large complement of ammunition, concertina wire, and sandbags. The M113's mobility allowed it to overcome improvised roadblocks and other obstructions.

Because of the ubiquitous ready-made fighting positions in urban terrain, and because of the typical concern for non-combatants, units must have access to direct fire weapons like the .50 caliber machine gun and anti-armor weapons. Too heavy for sustained dismounted operations, the M113 is an appropriate platform for these weapons.

THE FOUNDATION FOR URBAN WARRIOR

Gangle, R.A.
"The Foundation for Urban Warrior"
Marine Corps Gazette
July 1998
Pages 52-54.

This article reviews urban warfare concepts under test by the Marine Corps Warfighting Laboratory. An historical review reveals four common features.

- The attacking forces surround and isolate the city and then conduct a linear, methodical sweep to clear enemy forces.
- This linear sweep results in numerous casualties for all parties in the city: friendly, hostile, and noncombatants.
- The consumption rates for small arms and grenades are extremely high.
- Urban combat is both physically and mentally exhaustive.

MCWL has formulated several experimental tactical concepts for urban operations based on experience gained from the dispersed operations in *Hunter Warrior*.

- *Urban Penetration* is designed for operations against clearly defined objectives. Sufficient mobility to move quickly along several axes with dispersed units are required. The objective is quickly seized, immediately isolated, and protected from the enemy. Stealth must play a major role in the initial movement phase.
- *Urban Thrust* occurs along a narrow axis (or axes) of advance with the intent to concentrate forces at chosen times and places. Other actions occur simultaneously to protect the flanks and obscure the true objectives.
- *Urban Swarm* envisions numerous small units (squads or fire teams) operating in a dispersed fashion. As these units patrolled their own sectors they are continuously available to respond to calls for assistance from neighboring units. The key to urban swarm is speed and flexibility. Implicit in this concept is increased levels of responsibility and command for junior officers. Units must take care not to develop predictable patterns of action and movement. This concept may be most useful in lower-intensity conflicts.
- *Active Urban Defense* deploys a minimal defensive screen while a larger mobile reaction force operates behind the screen. This serves to confuse the enemy as to the true location of the main force and can contribute to the diversion of his forces to non-critical areas of the battle. The mobile reaction force also allows for quick responses to local emergencies.

BATTALION AID STATION SUPPORT OF MILITARY OPERATIONS ON URBANIZED TERRAIN

Gbur, C.J.
"Battalion Aid Station Support of Military Operations on Urbanized Terrain"
Marine Corps Gazette
February 1999
Pages 22-25.

Military operations in urban terrain involve a high potential for casualties and present a unique environment that can severely test the capabilities of medical units. Medical personnel will have to work in large unsecured areas. This will demand improved combat skills training for medical personnel, especially with regard to the sniper threat, and the use of armored ambulances. An ambulance version of the LAV would be ideal. Although helicopter evacuation is preferable, there may not be suitable landing zones in the area. Mobile armored intensive care units will be needed.

A key problem will be the location and extraction of casualties in the confined terrain of buildings and rubble. Once located, evacuation should be preformed by medical personnel. Current operating procedures call for litter carriers provided by line companies. A better approach would be to gather organic medical personnel at the battalion aid station and make them responsible for all aspects of casualty evacuation. This would prevent the diversion if large numbers of combat troops from the fight.

Battlespace awareness will be critical to delivery of medical services and survival of medical personnel. Medical teams should have GPS equipment and be cross-trained in radio use. The battalion aid station must become the central command and control center for the delivery of medical care.

Because of the large number of civilians in the urban environment and the possibility of preexisting medical infrastructure, medical personnel should liaison with local authorities.

[GLENN 1999]

FOX TROT: SEEKING PREPAREDNESS FOR MILITARY URBAN OPERATIONS

Glenn, R.W.
"Fox Trot: Seeking Preparedness for Military Urban Operations"
Armed Forces Journal International
May 1999
Pages 46-49.

Dr. Russell W. Glenn, a senior defense and political Analyst at RAND, examines the positive and negative aspects of the US military's ability to prosecute operations in urban terrain, "Fox Trot: Seeking Preparedness for Military Urban Operations." On the positive side, Glenn praises the Army and Marine Corps for updating their urban warfighting doctrine and lauds the increasing number of exercises, experiments, programs, and organizations that wrestle with the issue of urban operations. On the down side, he laments the lack of adequate training (in terms of facilities and programs), the idealistic nature of many of the rules of engagement currently under development for urban operations, the growing mismatch between requirements and capabilities in the acquisition of weapons and weapon systems (when considered in the context of urban operations), and the lack of centralized oversight and advocacy for urban initiatives. Glenn concludes his article by noting that "Without a strong joint champion as a guide…future enemies, resource struggles, and lack of awareness will impede advances" in developing a robust urban warfighting capability.

CHANGING RUSSIAN URBAN TACTICS

Grau, L.W.
"Russian Urban Tactics: Lessons from the Battle for Grozny"
INSS Strategic Forum (38)
July 1995
Pages 1-4.

Lester W. Grau at the Foreign Military Studies Office at Fort Leavenworth, Kansas notes that Russian preconceptions concerning urban warfare were shattered in the streets for Grozny. In "Changing Russian Urban Tactics: The Aftermath of the Battle for Grozny," Grau examines these preconceptions and details some of the lessons learned from the first campaign against the Chechens.

Under the Soviets, military doctrine posited that urban warfare would occur in conjunction with large-scale, high tempo offensive operations and that undefended cities would be captured, while defended cities would be bypassed. The military doctrine also assumed that the enemy was a professional soldier who valued the continued existence of cities over their destruction. The Russian campaign against Chechnya set existing military doctrine on its head.

The Russians envisioned the campaign against Chechnya as another march against Prague or Kabul, where the indigent military forces would offer little or no resistance. When the initial New Year's Eve assault on Grozny was repulsed, the Russians, rather than organizing and preparing for a campaign against the capital, responded by sending a hastily assembled force of composite units into the city as part of a police action. The result was a dismal failure.

Through these failures, and later experiences, the Russians identified several important lessons learned. These lessons include:

- *Cities must be dissected*. The Russians concluded that for urban operations to be successful, the city must be isolated, "key installations" on the fringes of the city must be seized, residential and industrial areas must be controlled and, finally, the military must destroy enemy units, clear mines, collect weapons, and establish control (e.g., curfews).
- *Intelligence is critical*. Russian planning occurred without detailed maps (e.g., 1:25,000). Few Russian commanders had access to satellite-based or airborne imagery.
- *Existing doctrine does not always suit current realities*. The Russians used *storm groups* and *storm attachments* for urban operations. Such organizations proved to be counterproductive. The preferred solution was to augment or enhance existing organizations as the situation required.

- *Urban warfare requires different types of equipment*. Russian experiences in Grozny identified a previously unknown requirement for large numbers of hand grenades, smoke grenades, one shot grenade launchers, grappling hooks, and disposable ladders. Antiaircraft guns and rotary wing platforms were more effective than tanks at suppressing snipers and weapons in upper stories. Pyrotechnics and searchlights blinded and dazzled enemy soldiers.
- *Artillery*. Indirect fire was useful in approaching cities, direct fire artillery support was preferable while advancing through cities.

URBAN WARFARE COMMUNICATIONS: A CONTEMPORARY RUSSIAN VIEW

Grau, L.W.
"Urban Warfare Communications: A Contemporary Russian View"
Red Thrust Star
July 1996
Pages 5-10.

In this article Grau describes the communications problems encountered by the Russians in Grozny (1994 to 1996) and possible solutions. Russian training for urban operations did not properly address communications because training centers were not large enough to replicate the real problems of urban communications. These problems are:

- Tall buildings and towers can absorb, block, reflect, and degrade FM and UHF radio signals.
- A limited number of frequencies, normally at the lower part of the band, work in cities. These frequencies can quickly jam up as both sides try to push too much traffic through too few frequencies.
- Wire communication links are vulnerable to breakage from vehicle traffic and artillery.
- Wire communication links can give away the location of command posts and takes 2 to 3 times longer to emplace in the urban environment.

Russian forces also transmitted in the clear on occasion. Chechen forces took advantage of this to monitor Russian movements, locate units to attack with artillery, and transmit false reports and orders. Chechen forces extensively used cellular phones, which work well in the urban environment. Apparently Russian forces collected intelligence and order of battle information through cellular intercepts.

Experience shows that proper planning can alleviate or eliminate many of the urban communications problems. An optimum signal plan needs to be formulated using directional antennas, proper frequencies, and secure voice communications. Directional antennas work much better the city. Wire still has a role to play, but it should be employed carefully. It should be protected from vehicle traffic and lines into command posts need to be buried so as not to indicate command post position. When possible, the civilian telephone network can serve for communications. To overcome building interference, aircraft can carry radio retransmission equipment, as they did in Grozny.

Several other technologies could also play a major role in the future urban communications. Encrypted cellular phones could frustrate collection efforts. However, fiber optic cables do not easily mesh with military wire communication links. Ham radios and computers are additional options.

RUSSIAN-MANUFACTURED ARMORED VEHICLE VULNERABILITY IN URBAN COMBAT

Grau, L.W.
"Russian-Manufactured Armored Vehicle Vulnerability in Urban Combat:
The Chechnya Experience"
Red Thrust Star
January 1997
Pages 16-19.

Grau examines the vulnerability of Russian armored vehicles within the context of the 1994 Russian campaign against the Chechens. Grau focuses on Chechen anti-armor techniques, the vulnerabilities of armored vehicles, and the implications for the future use of armored vehicles (especially within urban environments).

Within the first month of the Russian campaign against Chechnya, over 10% of the armored vehicles committed to the campaign were listed as non-repairable battle losses. The Chechens engaged and defeated armored vehicles through employment of anti-armor hunter killer teams consisting of three to four man cells, which typically consisted of an anti-tank gunner (armed with a RPG), a machine gunner, and a sniper. These teams utilized the urban environment to limit the combat effectiveness of armored vehicles, the main guns of which had a limited ability to engage targets above and below certain elevations. The machine gunners and snipers pinned down supporting infantry and the anti-tank gunners then attacked armored vehicles, aiming at weak points in the armor (e.g., their tops). Eventually, the Russians employed a systematic "house by house, block by block" approach that limited Chechen ability to perform such tactics. Furthermore, the Russians employed anti-aircraft guns to suppress Chechen forces in urban environments.

Fuel cells and engines were often the preferred target for Chechen anti-tank gunners. While it typically took a volley of three to six rounds to incapacitate such vehicles, the Chechens ability to fire down on the relatively vulnerable top armor enabled them to realize positive results using relatively crude anti-tank weapons. Some effective Chechen techniques for engaging and defeating armor included:

- Using anti-armor hunter killer teams as an effective model,
- Situating ambushes to minimize the maneuverability of armored vehicles,
- Suppressing supporting units (e.g., infantry, air defense guns) first, and
- Using the urban environment as a force multiplier. The ability to engage armored forces from several levels (e.g., basement, street level, upper floors) allowed attackers to target vulnerable areas on the armored vehicle.

THE RPG-7 ON THE BATTLEFIELDS OF TODAY AND TOMORROW

Grau, L.W.
"The RPG-7 On the Battlefields of Today and Tomorrow"
Infantry
May-August, 1998
Pages 6-8.

Grau provides a compact discussion of the RPG-7 and the tactics of its employment. He draws examples from Angola, Somalia, Afghanistan, and Chechnya.

> "The RPG-7 anti-tank grenade launcher is one of the most common and effective infantry weapons in contemporary conflicts. It is rugged, simple and carries a lethal punch. Whether downing US Blackhawk helicopters in Somalia, blasting Russian tanks in Chechnya, or attacking government strong points in Angola, the RPG-7 is the weapon of choice for many infantrymen and guerrillas around the world."
>
> Constricted terrain (mountains, forest, jungle, and population centers) leads to close combat. When the combatants are 10 to 30 meters apart, artillery and air support is practically nonexistent due to the danger of fratricide. Close combat is a direct-fire brawl in which the RPG-7 excels."

Originally fielded in 1961, the RPG-7 is manufactured around the world. Shoulder fired, weighing about 15 lbs., it can launch a variety of munitions from a 40 mm tube. Its maximum effective range against a moving target is 300 meters and is 500 meters against stationary targets. The anti-tank round can be used as an area weapon reaching out to 920 meters while the anti-personnel weapon can reach to over 1100 meters. A tandem warhead (PG-7VR) can penetrate reactive armor.

Anti-armor tactics include attacking tanks with two or three RPG teams. Against reactive armor, the first round neutralizes the armor, while the second and third destroys the tank.

Infantry accompanying tanks were the greatest threat to RPG teams. A counter is teams including automatic weapons, sniper, and RPGs. A counter-counter was to deploy infantry far forward of the tank to engage RPG teams.

Anti-helicopter operations are also accomplished by RPGs and automatic weapons sitting in ambush around anticipated landing zones that might also be mined.

A common procedure in RPG tactics was to shoot then move. The visible signature of RPG firing invites a lethal response.

HANDLING THE WOUNDED IN A COUNTER-GUERRILLA WAR

Grau, L.W. and Jorgensen, W.A.
"Handling the Wounded in a Counter-Guerrilla War: the Soviet/Russian Experience in Afghanistan and Chechnya"
U.S. Army Medical Department Journal
January-February 1998
http://www.ndu.edu/inss/strforum/forum38.html

Compared with Afghanistan, Russian forces in Chechnya did not use air evacuation as much, particularly after Chechen forces shot down several medical evacuation helicopters. Wounded were normally evacuated in armored ambulance (BTR-80). In Grozny there was a higher percentage of burn wounds, and mortar fire caused the majority of wounds. The bulk of those killed were hit in the head or chest by sniper fire. While the normal ratio of wounded to killed was 3:1 or 4:1, in Grozny it was 1:3.

Some of the lessons learned by Russian forces fighting in Grozny were:

- Medical facilities need to be closer to the fighting and better protected from enemy fire, possibly dug in.
- In constricted terrain armored ground transport is the preferred method of casualty evacuation.
- Burns, shrapnel, and sniper wounds are far more common in MOUT.

In the authors' opinion, improvements needed to be made in the initial treatment given to the wounded.

"SOFT LOG" AND CONCRETE CANYONS: RUSSIAN URBAN COMBAT LOGISTICS IN GROZNY

Grau, L.W. and Thomas, T.L.
"Soft Log and Concrete Canyons: Russian Urban Combat Logistics in Grozny"
Marine Corps Gazette
October 1999
Pages 67-75.

This article reviews Russian logistical efforts associated with the two-month battle for Grozny in 1995. A central point is that urban combat drastically increases ammunition use and logistical needs. The Russians wanted to fight a linear battle, but the Chechens made it a non-linear fight. The Russian logistical system was unprepared for this. Getting supplies up to combat units was much more difficult when the "front line" was constantly shifting. Resupply units were poorly suited to traverse unsecured territory. Medical units encountered the same problem. There was a chronic need for armored vehicles to do both resupply and casualty evacuation. Medical evacuations were often conducted by make-shift BTR-80 ambulances.

Russian medical support was usually well-planned and executed once casualties reached battalion aid stations. However, the Russian record on disease control was worse. Russian soldiers frequently lacked clean drinking water. Also contributing to the medical workload was a higher than normal number of psychiatric casualties. Mitigating the medical workload was a much higher proportion of KIA to WIA. The normal three to four wounded for every dead soldier ratio was reversed to three dead for every wounded. This ratio reversal may reflect the difficulty in getting to wounded personnel quickly.

A key limitation on the Russian logistical effort was a lack of time to plan for the operation, something Moscow's political leadership did not provide. Serious traffic control problems and inadequate truck transportation were symptomatic of this. Russian forces were not prepared to handle the large number of prisoners and detainees. Rail moved the bulk of the supplies into the theater.

Items like small arms ammunition, high explosive and smoke grenades, flame thrower rounds, RPG rounds, tear gas grenades, ladders, grappling hooks and ropes, and night vision equipment were all in high demand. Mortar ammunition and smoke rounds for the heavy artillery were used are in heavy quantities. The ZSU-23-4 anti-aircraft vehicle was very useful because it could elevate its gun and engage targets on the upper floors of buildings. Consequently, keeping that high-demand system in 23 mm ammunition was a constant problem.

MOOTW: FIGHTING THE CLOSE QUARTER BATTLE

Greene, S.J.
"MOOTW: Fighting the Close Quarter Battle"
Marine Corps Gazette
September 1996
Pages 85-86.

This article reviews current tactical doctrine for clearing buildings and finds it lacking for military operations other than war (MOOTW). In current doctrine the grenade is a basic tool for clearing rooms. However, the use of combat power in MOOTW must be discriminate and characterized by legitimacy and restraint. To continue to rely on the indiscriminate application of firepower is a recipe for disaster.

The long-term answer to the problem lies in training. The Marine Corps should adopt the concept of Enhanced MOUT (EMOUT) as the standard for predeployment of combat units anticipating MOOTW. The EMOUT training concept originated at the Marine Corps Security Force Battalion's Fleet Antiterrorist Support Team Company. EMOUT blends shooting and tactical skills and is specifically designed to discriminate targets under restrictive rules of engagement.

While serving as a Marine Corps Security Force guard officer (1992-1995), the author participated in training three different guard platoons. The training consisted of a week-long 60-hour package of instruction and evaluation. A building-block approach focused on entry-level close quarter battle (CQB) skills but replaced the submachine gun and specialized CQB gear with standard infantry weapons and equipment. The emphasis was on discriminate and accurate shot placement. The actual expenditure of rounds per man in EMOUT training was less than when training with the submachine gun because of the Marines' familiarity with the M16A2 rifle.

OPERATIONS IN URBAN ENVIRONMENTS

Groves, J.R. Jr.
"Operations in Urban Environments"
Military Review
July-August 1998
Pages 31-40.

Brigadier General Groves, of the Kentucky National Guard, states that urban operations tie together strategic, operational and tactical issues. The complexity of urban operations is such that no one training template will suffice. There are a range of operations, and preparation should include both policy makers and military commanders. Decisions to intervene should take into account the interests threatened, the end state, the cost in blood and dollars, duration, level of violence, and moral and humanitarian concerns.

Operations intelligence will be of great importance, civil affairs and PSYOPS being central to that effort. In fact, tactics may lie less with the numbers of troops and more with an understanding of the battle area at all levels (geographic, demographic, political and social). This understanding will help clarify the true centers of gravity that may be a person, object, symbol, or socio-political condition. Transition to the post-conflict phase will also benefit from a better "big picture" view. Certain military options may be deemed undesirable when viewed through the lens of long-term stability.

The United States is virtually alone at the top of the military technology pyramid. However, the effectiveness of its technology in the urban environment remains to be seen. As warfare becomes less conventional, raw military power may not be decisive. The US technology advantage may be outweighed by an asymmetry of interests. If it loses, a small insurgency force faces annihilation, while US forces merely face embarrassment, and the smaller and less capable protagonist may win. Rules of engagement relate to this. By their nature ROE are unilateral, and future foes will take maximum advantage of that fact. In future urban operations the political limitation via ROE may be greater than the limits of military capability.

PREPARING FOR TODAY'S BATTLEFIELD

Hammes, T.X.
"Preparing for Today's Battlefield"
Marine Corps Gazette
July 1997
Pages 56-62.

This article addresses the likelihood of urban combat and the quantity and quality of current training. The author begins by giving five reasons why US forces are likely to see future urban fights.

- Populations are shifting into the cities. From 1950-1995 the number of cities with 1+ million population increased from 34 to 213 in the developing world alone.
- That population increase is leaving behind the ability of infrastructures and governments to support it. This will lead to increasing disorder as restive populations look to radical solutions to rectify their living conditions.
- Reduced US bases overseas. Without bases in theater US forces will need to enter via port and airport facilities, which are almost always in urban areas.
- The large majority of current conflicts are in or around cities.
- The most likely opponents of US forces in fourth generation war are terrorists, insurgents, and criminals, many of whom have migrated to the cities.

Contrasting with this trend is the urban training done by the Marine Corps. The author mentions that basic training still contains the same three to four day urban package he saw 20 years ago, when he attended. He observed the training of half a dozen infantry battalions and less than 20% of their training was for urban combat and much of that was wrong. There has been a spillover in tactics from the police/hostage rescue side of operations. While effective for what they are intended to do, the author believes that these tactics will get marines killed in urban combat. Police tactics are built on two assumptions that a marine in urban combat can not make. One is that the operation will take place with a secure perimeter, eliminating any threat other than the target itself. The second is that the foe will not use explosive type weapons like the RPG, mines, and hand grenades. In urban combat Marines have to worry about threats from every direction at all times. They also must avoid bunching up (e.g., stacking), which presents a perfect target for any explosive weapon. The training environments Marines train in are also too sterile. They need to better replicate Third World cities.

Training sites can be improved by adding: breached walls, rubble, wrecked vehicles, furniture, and shanty towns. The training manuals need to be reprinted without illustrations or tactics from the police perspective. Aggressive remedial training is also needed to purge inherited bad habits. A general shift in training from today's 90/10 ratio in favor of rural combat needs to change to a 40/60 split in favor of urban.

TIME TO GET SERIOUS ABOUT URBAN WARFARE TRAINING

Hammes, T.X.
"Time to Get Serious About Urban Warfare Training"
Marine Corps Gazette
April 1999
Pages 19-21.

Colonel Hammes sees a divergence between Marine Corps proclamations about urban warfare being the future and how it trains for the future. He sees today's training as the same as it was in the 1970's, 99.9% rural. However, he argues that with a little ingenuity, the Marine Corps can correct this deficiency. The individual skills that need work are:

- *Urban combat shooting*. This does not require urban specific training areas, current live fire facilities will do. The focus needs to be on shooting at shorter ranges, target discrimination, and sharpshooting.
- *Urban movement*. Movement in the urban area is a distinct skill. Marines need to train for the full spectrum of urban scenarios. Marines must learn to think 360 degrees and learn to analyze urban cover. One of the most important tasks is to see that marines do *not* use civilian police movement tactics, as those will get marines killed in combat.
- *Urban communication*. This is the most difficult aspect of urban combat. To understand the problems and devise solutions, communications training needs to be a constant component of all urban training.
- *Weapons effects training*. Marines must understand the effects of their own personal weapons and crew served weapons. Without that knowledge, they risk both friendly and noncombatant casualties.

The facilities in use today are too pristine. What's needed is training facilities that look lived in, complete with slums, trash, junk cars, furniture, rubble, and battle damaged buildings.

Unit techniques must also be practiced, covering the full spectrum from security to all-out combat. Use two-sided free-play exercises whenever possible. Force-on-force exercises conducted at the small unit level can pull it all together. One inexpensive option would be to equip each marine with a paint ball mask and lever action BB gun. While the BB guns have very short ranges, they would work well for interior fighting.

URBAN TANK EMPLOYMENT PROPOSAL FOR THE 21ST CENTURY

Harding, E.H.
"Urban Tank Employment Proposal for the 21st Century"
Marine Corps Gazette
December 1999
Pages 37-39.

Lieutenant Harding begins by describing the need for new urban techniques, tactics, and procedures for the Marine Corps tank community. Marine infantry has three needs in the urban fight that tanks can support:

- *Precision fire support*. The M1A1's excellent fire control system can engage targets precisely with either the main gun or machine guns.
- *Quick reaction force*. Tanks acting in this role could have made a big difference in Mogadishu.
- *Mobile reserve*. This allows the commander to move firepower quickly.
- *Survivable and overwhelming fire support*. The M1A1 carries its own large ammunition load without overloading the infantry.

The answer is a mobile react team. Each MRT would compose one tank section supported by an infantry squad and engineer team, mounted on two assault amphibious vehicles. The MRT would stay two to three blocks behind advancing infantry. The support the MRT gives could come in three forms: as an on-call assault gun, as a manned roadblock force, or it could stay back at a nearby compound and sortie as needed.

Currently, joint infantry/tank MOUT training is rarely conducted. The first step would be to make it an annual requirement. What is needed is a 12 by 12 block MOUT training facility complete with shanty villages surrounding the outskirts. Such a training space would allow armor (heavy and light) to test urban warfare tactics.

F/X FOR URBAN WARFARE

Hasenauer, H.
"F/X for Urban Warfare"
Soldiers
June 1998
Pages 7-9.

The facility engineers building the first urban combat training center for armor units made realism a priority. In working on the Fort Knox (Kentucky) facility they visited urban training sites around the world and assimilated lessons learned from Bosnia. At the time of the article, the 26-acre complex had 21 structures with an opening date of June 1999. While the training site was primarily for the use of the Armor School, it would also be made available to non-school units. Commanders will be able to expose their troops to situations ranging from urban unrest to mid-intensity combat situations.

The facility will include everything from synthetic sewer stench, to computers, to a bridge that emits smoke as though it were on fire, and "blow out" roofs that allow troops to break through buildings without permanently destroying them. Rooms will have furniture, yards will have playground equipment, and cars will line the streets. Computers will operate .50-caliber compressed-air flame points and 37 mm antitank paint ball launchers.

[HERBERT 1999]

NON-LETHAL WEAPONRY: FROM TACTICAL TO STRATEGIC APPLICATIONS

Herbert, D.B.
"Non-Lethal Weaponry: From Tactical to Strategic Applications"
Joint Forces Quarterly
Spring 1999
Pages 87-91.

In "Non-Lethal Weaponry: From Tactical to Strategic Applications," Dennis Herbert, a retired Marine colonel, examines the technical evolution of non-lethal weapons, their growing relevance to the operational and strategic levels of war, and the challenges that still exist in developing and applying non-lethal technologies. Herbert contends that advances in non-lethal technologies will, in the current and anticipated geostrategic environments, enable the US military to respond to a broad range of contingencies with greater flexibility.

Herbert notes that the implications of tactical events extend beyond national boundaries, thus requiring troops capable of responding to tactical events in such a way as to not endanger strategic interests. Herbert also contends that non-lethals provide commanders with a means of responding to tactical events in such way as not to turn local popular support and international opinion against America's military actions. Finally, in light of the trend of global urbanization, Herbert believes non-lethal technologies offer the warfighter a means of operating in populated urban environments without causing an undue number of civilian casualties.

With regards to the future of non-lethal technologies, Herbert believes the disjointed acquisition of tactical weapons will yield to the coordinated development of a family of non-lethal technologies for employment at the tactical, operational, and strategic levels of war. He cites two reasons for this shift: the effective use of non-lethal weapons at the operational (and strategic) level of war in Desert Storm (e.g., computer viruses, carbon fibers) and the naming of the USMC as the executive agent for the development of non-lethal weapons.

In closing, Herbert notes that DoD and the services must address some legal, ethical, and environmental issues before employing non-lethal technologies as a familiar and useful option for military commanders.

LIGHT/ATTACK HELICOPTER OPERATIONS IN THE THREE BLOCK WAR

Hewson, H.J.
"Light/Attack Helicopter Operations in the Three Block War"
Marine Corps Gazette
April 1999
Pages 25-27.

In this article Major Hewson, a Marine Corps Cobra pilot, addresses the role a Marine light/attack helicopter squadron can play in urban operations. He sees the helicopter squadron's flexibility as key to its role in the "Three Block War." In lower threat scenarios the Huey is an excellent platform for high situational awareness overwatch and casualty evacuation. Hueys can also provide quick mobility when mines, roadblocks, or rubble prevent safe ground movement. When enemy forces employ "hugging" tactics their closeness to friendly forces can preclude the use of fixed-wing air support. Attack helicopters can also act as a substitute for fixed-wing aviation.

Hewson states that within the Marine Corps there is a belief that helicopters are not survivable in the city. He calls that reasoning flawed. While the shoot down of several UH-60 Blackhawks in Mogadishu received much attention, what is often forgotten is that both Cobra and AH-6 Little Bird attack helicopters flew extensively without loss. In Chechnya the Russians lost only 12 helicopters in over 6,000 combat support missions. The lesson from those examples is that the aircrews can quickly develop tactics that greatly enhance their survivability.

Unfortunately, Marine helicopter urban training opportunities are rare. Currently, urban live fire ranges do not exist for aircraft-delivered munitions. Hewson believes that while the risks of operating helicopters in the city may seem high, they can succeed with the right mix of tactics and training.

MARINES ASSAULT THE JOINT READINESS TRAINING CENTER

Hoffman, J.T.
"Marines Assault the Joint Readiness Training Center "
Marine Corps Gazette
February 1999
Pages 34-36.

This article examines the participation of Marine units in exercises at the Joint Readiness Training Center (JRTC). Created in 1987, the JRTC moved in 1993 from Fort Chaffee (Arkansas) to Fort Polk (Louisiana). Its mission is to train non-mechanized infantry brigades in challenging force-on-force scenarios, complimenting the armor-focused National Training Center at Fort Irwin (California). The primary focus of training at the JRTC is on the battalion, with the brigade next in line, and companies/platoons receiving third priority. In the past the facility had been used mostly by the Army. That changed in November 1998 when a Special Purpose Marine Air-Ground Task Force (Experimental) was invited to train there with elements of the Army's 82nd Airborne Division.

Two lessons emerged from the exercise. One was that the Marines got a close up look at the Army's state-of-the-art MOUT training facility. The buildings are fully instrumented to allow for detailed feedback on training evaluations. However, the facility suffers from the same drawback as every other MOUT training site, it is too small. It amounts to a village rather than the true cityscape future forces are likely to confront. While many strategic thinkers believe urban battles will be a major factor in future war, most training still focuses on the company level. The author argues that it is time for DoD to create a MOUT counterpart to the NTC and JRTC. Conceivably, one of the military bases subject to closure could provide the initial land and support facilities.

A second lesson was the effectiveness of small teams versus a conventional force. The JRTC OPFOR has a conventional and guerrilla force. The guerrilla force operates in dispersed three to five man teams, with individual 82 mm mortars in support, and routinely achieves seven to one kill ratios against visiting units. The visiting units usually do better against the conventional opposing forces. That leads to the question of what small teams could achieve, if backed by air support and the firepower of modern American forces. The JRTC would provide the forum for future tests of an infestation-style force against an Army brigade or Marine Expeditionary Force.

PLATOON UNDER FIRE

Hollis, M.
"Platoon Under Fire"
Infantry
January-April 1998
Pages 27-34.

In "Platoon Under Fire," Captain Mark A.B. Hollis, describes his platoon's actions during the October 3-4, 1993 battle in Mogadishu, Somalia. The mission, conducted by the UN Quick Response Force, was to rescue elements of Task Force Ranger, isolated and under attack after the shoot down of their Blackhawk. One of the platoons involved in the rescue and recovery operation was itself become separated and encircled by hostile forces. It had to break out and link up with friendly forces.

The battalion rotated missions between its three companies: Companies A, B, and C. In addition to its three rifle companies, the battalion had engineering, transportation, and artillery support. Captain Hollis led the 2d Platoon, Company A, 2d Battalion, 14th Infantry, 10th Mountain Division. Company C was assigned the QRF mission initially, and attempted the rescue via 5-ton trucks. They sustained heavy losses as the trucks proved easy targets for Somali irregulars with rocket propelled grenades. Company A, initially in support, then reinforced.

The plan called for Pakistani tanks to lead 2d Battalion soldiers aboard Malaysian armored personnel carriers to the Blackhawk crash site. The tank crews decided to cut their escort duties short of the crash site, leaving the APCs on their own. The APCs did what APCs are supposed to do, protect the infantry from small arms fire, but were all destroyed, when attacked with RPGs. The platoon, on foot, became separated from the rest of the force. Small attack helicopters (the special operations AH-6, a modified light observation helicopter) provided effective close air support.

Once the tanks left the formation and the APCs were destroyed, combat was at close range with small arms, grenades, and smoke. Holes were blown in walls. Urban structures provided cover and concealment. Communications problems were common.

A few lessons emerge from this article.

- *Tanks.* Because the Pakastani tanks left the formation early, there is not much to learn about heavy armor from this event.
- *Armored Personnel Carriers.* Limited visibility and thin armor were problematic. The light armor was no match for unsophisticated and common weapons like rocket propelled grenades.
- *Trucks.* Inadequate against small arms and RPGs at close range from concealed positions

[HOLLIS 1998]

- *Infantry.* Small unit tactics and short range weapons were key to survival. Small units will function independently intentionally or otherwise. Even the smallest units must be combined arms teams.
- *Aviation.* A small observation helicopter adapted to infantry support, armed primarily with small caliber automatic weapons, showed great utility.

Problems stemming from the US soldiers' lack of familiarity with allied weapon systems are more a problem of coalition operations than of urban operations. The last minute formation of combined arms teams is also problematic, but is a well-known lesson applicable across environments.

NIGHT STALKERS AND MEAN STREETS: AFGHAN URBAN GUERRILLAS

Jalali, A.A. and Grau, L.W.
"Night Stalkers and Mean Streets: Afghan Urban Guerrillas"
Infantry
January-April 1999
Pages 20-26.

Ali A. Jalali and Lester W. Grau are the authors of the book, *The Other Side of the Mountain: Mujahideen Tactics in the Soviet-Afghan War*. The article "Night Stalkers and Mean Streets" is a series of extracts from the portion of the book dealing with urban guerillas in the 1979–1989 war. The Afghan rebels fought the Soviets and the troops of the Democratic Republic of Afghanistan. The Soviets and the DRA never controlled the major cities of Kandahar and Herat, although they had somewhat greater success in controlling the capital city of Kabul.

Guerilla targets were soft and included government buildings and infrastructure. Targets had political and psychological, not military significance. The Afghan urban guerilla fought small, short duration fights, mostly at night. Operations tended toward raids and ambushes. Key to ambushes was the guerilla's ability to collect detailed knowledge of the occupying force's position and movement. Kidnapping of political prisoners and capture of military prisoners were often objectives. Arms capture was a common theme of operations. Operations were conducted by small groups numbering 5, 15, or 50 fighters. Such groups were never strong enough to capture a city, but through their actions created a siege mentality in the city populace, while diverting enemy troops from the main battle in the countryside. The Soviets and the DRA either exerted dominant physical control, or had none at all.

Guerrillas in the city were surrounded by potential informants. Government forces could react to insurgent acts more quickly in the city than in the countryside. Insurgents were typically forced to move through the city unarmed. As a result, many lived in the countryside or suburbs and commuted to town for operations. Larger units had to secure their routes of ingress and egress with up to two-thirds of their force. Guerrillas masqueraded in captured uniforms. Some worked by day in official government capacity. Soviet conscripts were easily corrupted. Uncertainty was the norm.

The AK-47 was the most common weapon, but handguns with silencers and knives were also numerous. The RPG-7 was the standard heavy weapon, but some larger units employed mortars and 82 mm recoilless rifles. Guerilla communications were very weak.

Unsophisticated bombs were frequently employed, placed inside buildings or hidden under pushcarts with produce for sale to military personnel. The results of bombing were lethal and often indiscriminate, but less so than the aerial bombardment employed by

Soviet air forces. Explosives and detonators were often transported by the elderly or the young and placed inside government buildings and meeting rooms by insiders.

SIMULATION SUPPORT FOR THE URBAN WARRIOR ADVANCED WARFIGHTING EXPERIMENT

Kelly, J.F.
"Simulation Support for the Urban Warrior Advanced Warfighting Experiment"
Marine Corps Gazette
January 2000
Pages 39-41.

Urban Warrior was a Marine Corps experiment to search for new concepts, tactics and technologies to fight and win in the city. It culminated in a live exercise in March 1999 in California. What was unique about this experiment was that the effects of indirect fire (in and outside of buildings) could be modeled using the Joint Conflict and Tactical Simulation (JCATS) computer model.

Each marine possessed a GPS unit and MILES laser detection gear. The GPS system would give the marine's location (with 1-meter accuracy) and "health status" at all times when outside. Because GPS does not work well inside, each building used in the exercise was instrumented to show the location of the marines inside. The MILES gear uses lasers and laser detectors to simulate direct fire. The JCATS system allowed participants to request indirect fire missions via normal channels. The results of those fires would then be calculated by JCATS depending on: flight time of the incoming fire, location of impact, and the location of live participants. JCATS has the ability to model urban terrain in great detail. One large 9-story hospital had all 900 of its rooms modeled.

An Integrated Marine Multi-Agent Command and Control System (IMMACCS) tied the sensors together. It provided a near real-time common tactical picture down to the squad level. The system provided position and health status updates on each of the live participants roughly every 30 seconds. With the IMMACCS system urban combat training can incorporate indirect fire systems. As a result, training is more realistic and effective.

WAR IN THE URBAN JUNGLES

Kitfield, J.
"War in the Urban Jungles"
Air Force Magazine
December 1998
Pages 72-76.

Mr. Kitfield, defense correspondent of the *National Journal* in Washington, DC, looks at the attitudes on the US military's role in urban operations. The two basic schools of thought are:

- Urban combat is too costly and should not be done because it throws away the US technology trump card. Taking the view that urban combat is unavoidable may create a self-fulfilling prophecy.
- Urban combat is not what the US military does best now but it is the wave of the future so it had better learn how to do it right. Rampant urbanization will place most of the world's people in cities. US military supremacy will push foes into the one environment they can survive in, the city. Third World cities may collapse under their own weight and create the need for humanitarian intervention.

US military doctrine advises the services to avoid urban conflicts whenever possible. Despite that, the Marine Corps, and to a lesser extent the Army, has taken the most aggressive stance in tackling the MOUT problem. Heightened US domestic political sensitivity to civilian casualties will make it impossible to use certain tried and true tactics, such as clearing a room by first blinding throwing in a grenade. Both the Marine Corps and Army have identified common challenges in MOUT. They say that urban operations will put a premium on reliable and timely intelligence. Unfortunately, current intelligence systems are not well suited for the urban environment. HUMINT requires increased emphasis.

Some experts see it as a problem that only four of the Army's ten active division are infantry oriented. This could make conducting manpower intensive urban operations difficult. Urban communications also pose the problem of radio transmissions. Robots could prove a critical tool for future MOUT. They could clear mines, locate snipers and detect chemical and biological weapons. Some experts see the urban fight as putting a premium on airpower and close air support over traditional artillery and indirect fire, because of concerns about shell trajectories and the need for precision. The demands of urban warfare will also likely revolutionize armored vehicles.

While efforts are being made to improve urban capabilities, there are limits to the changes the Army and Marine Corps will make. Both services are resisting calls to form specialized urban combat units, citing the continuing need to conduct operations in open terrain.

ARMOR'S ROLE IN FUTURE U.S. MOUT DOCTRINE: FACING UP TO THE URBAN FIGHT

Klug, J.P.
"Armor's Role in Future U.S. MOUT Doctrine: Facing Up to the Urban Fight"
Armor
May-June 2000
Pages 7-11.

Captain J.P. Klug's "Armor's Role In Future U.S. MOUT Doctrine" is more a call to arms directed at his colleagues in the armor advanced course than it is a description of the armor branch's role in MOUT.

Klug begins with a quick survey of four important documents that identify urban operations as important targets for training and doctrine development:

- *1996 Joint Strategy Review Report*,
- *Joint Vision 2010*,
- the *1997 National Defense Panel Report*, and
- Rand's *Marching Under Darkening Skies: The American Military and the Impending Urban Operations Threat*.

The Rand report identifies the need to update the Army's *FM 90-10, Military Operations in Urbanized Terrain*, written in 1979, and the need for an armor companion manual to *FM 90-10-1, An Infantryman's Guide to Combat in Built-up Areas*.

The author incorrectly states that the Marine Corps is the assigned executive agency for MOUT training and fighting [n.b., it is executive agent for doctrine production]. Klug theorizes that an Army medium weight brigade could augment a Marine Expeditionary Unit already in theater and suggests the need for close Army-Marine Corps cooperation in MOUT training and doctrine development. The article includes a quick summary of Marine Corps activity including

- General Krulak's concepts of the three block war and strategic corporal,
- marines receiving training at the British Army's Copehill Down MOUT training facility with US law enforcement agencies,
- the establishment of a Marine Expeditionary Force MOUT Instructors Course,
- Operation Urban Warrior conducted on a closed 183-acre navy hospital campus, and
- the creation of Yodaville, an urban bombing range near Yuma, Arizona.

The author also lists four doctrinal publications soon to be released, to include

- Joint Publication 3-06, Doctrine for Urban Operations,
- FM 90-10, Military Operations on Urbanized Terrain,
- FM 90-10-1, A Guide To Combat In Built-up Areas, and
- FM 90-10-X, MOUT Mission Training Plan.

Having covered doctrine on the publications front, the author turns his attention to a handful of other issues. The first is the USIPECT Concept (understand, shape, isolate, penetrate, exploit, consolidate, and transition) that he elaborates on in tabular format. USIPECT will likely replace the formerly accepted four phases of offensive operations in MOUT: reconnoiter the objective, isolate the objective, secure a foothold, and clear the built-up area. [n.b., USIPECT has already been made obsolete by USECT.]

The next issue he addresses is the role of medium brigades. The author speculates that they might prove useful in three possible scenarios. "First, they may have to defend an urban center of gravity from a hostile force. Second, they may have to attack a rogue government's forces located in an urban area and reestablish a previous legitimate government. Third, they may have to isolate a large urban area and then wait for additional forces to move into theater and conduct offensive operations."

The role of UAVs will include use as reconnaissance assets, forward observers, and target designators, and in a close air support role. The Air Force contribution appeared limited to the use of PGMs, but some refinement will be necessary to allow standoff distances without lost of accuracy.

Combat support and combat service support issues were plentiful, particularly the role of engineer branch specialties: combat engineers and construction engineers. The skills needed in the urban environment include breaching obstacles, opening or destroying buildings, smoke, casualty evacuation and vehicle recovery. The list of logistics issues can be summarized as "constant improvisation."

'URBAN WARRIOR' – A VIEW FROM NORTH VIETNAM

Lamont, R.W.
"'Urban Warrior' – A View from North Vietnam"
Marine Corps Gazette
April 1999
Pages 32-33.

In this article, Lieutenant Colonel Lamont looks at the urban combat techniques used by North Vietnam in its 1975 Spring Offensive. To attack urban areas the North used a technique they first developed in the early 1950s called the "blooming lotus." This tactic avoided the defenses on the city's perimeter while driving fast-moving columns into the city center. Once in the interior the C^2 nodes there were attacked. Only then were the now leaderless and confused units around the city's perimeter defeated piecemeal. This approach contrasts sharply with the outside-in method of Western doctrine.

Two critical problems presented themselves to the Northern commander using this tactic. The first was to precisely locate both the forces guarding the city's perimeter and the C^2 nodes within. This required excellent intelligence collection. The North Vietnamese relied on the "revolutionary structure" HUMINT network within each city to supply that information. The second problem was securing key roads and bridges to permit mounted columns fast access to the city center. This was accomplished by infiltrating sapper and infantry teams prior to the attack. This again required intelligence on where these critical transport points were.

The key lesson for today's Marine Corps is the importance of HUMINT. Only by blending HUMINT with the technical side of intelligence collection can a MAGTF commander hope to identify the right centers of gravity.

A TALE OF TWO CITIES – HUE AND KHORRAMSHAHR

Lamont, R.W.
"A Tale of Two Cities — Hue and Khorramshahr"
Armor
May-June 1999
Pages 24-26.

Lieutenant Colonel R. W. Lamont's "A Tale of Two Cities" succinctly and clearly captures a handful of meaningful lessons about armor in urban environments. He uses two short case studies, one of the US vs. NVA in Hue 1968, the other the 1980 battle of Khorramshahr in the Iran-Iraq war. The two cases are well chosen, both cases having much in common, but each having something unique to offer.

In 1968 the city of Hue had a population of 140,000 with suburbs and an older city center divided by a river. The rural area surrounding the city was contested. Two friendly compounds were in the city, the MACV command post and an ARVN division headquarters. The NVA had no armor throughout the 22-day battle. The marines had infantry, M-48 tanks, and Ontos antitank weapons (small, tracked, lightly armored, with 6 externally mounted 106 mm recoilless rifles and a .50 caliber machine gun, long gone from the USMC inventory).

Phase one of the operation was to reach and relieve the MACV compound. Forces initially available, and later designated Task Force X-Ray, were a Marine rifle company joined en route by a tank platoon. The approach to the city was by truck, but infantry moved to tanks to enter the city. The force made a rapid penetration to the MACV compound before the enemy could react.

Following the penetration and relief, Task Force X-Ray grew to infantry battalion size with a platoon of M-48 tanks and Ontos antitank weapons. The larger force allowed the second phase of offensive operations to commence. The tanks provided direct fire support and relief of small infantry units under fire. In addition, the tanks could open new routes by knocking down walls to allow infantry maneuver and casualty removal. In tactical operations, tanks led and infantry followed.

X-Ray grew to an infantry regiment with a tank company and an Ontos company. Weather reduced the air support that the marines were accustomed to, and additional fire support requirements fell to the tank and Ontos. Phase three began. Tactics included a pairing of tank and Ontos. The tank provided pinpoint fire, the ability to draw out the enemy, and protection. Loaded with shotgun-like canister rounds, the Ontos fired all six of its recoilless rifles at close range providing an area weapon that forced the enemy to ground. When tank ammunition was exhausted, assaults stopped. Combined arms operations were absolutely necessary.

Ammunition consumption rates were higher than planning factors for heavy field fighting. Casualties were high for both defender and attacker.

Like Hue, Khorramshahr, had both suburbs and a center city. The city of 175,000 had a strategic location and was near a waterway. Both Iranian and Iraqi forces had armor and infantry, but the Iraqis had numerical superiority in both. Casualties for both defender and attacker were high during the 25-day battle.

The Iraqis initially penetrated through the suburbs quickly. There were tank battles in the suburbs, but Iranian tank and infantry teams in the defense halted the Iraqi advance on several occasions, forcing armor/infantry combined arms attacks to overcome the defender. The Iraqis' ability to conduct effective combined arms attacks was apparently not impressive, and eventually the uneven force ratio determined the outcome. In the city core, however, tanks operated in a supporting role, firing down long streets, for example. Infantry went from house to house clearing stubborn resistance.

MOUT AND THE 1982 LEBANON CAMPAIGN: THE ISRAELI APPROACH

Leaf, J.D.
"MOUT and the 1982 Lebanon Campaign: The Israeli Approach"
Armor
July-August 2000
Pages 8-11.

Captain James D. Leaf is a special forces officer who wrote "MOUT and the 1982 Lebanon Campaign" while attending the armor officer's advanced course. Leaf succinctly captures the essence of three urban operations conducted in 1982 by the Israelis in Lebanon. The three urban centers are Tyre, Sidon, and Beirut. The Israeli Defense Force objectives were to drive the PLO out of Lebanon and reduce Syria's influence in Lebanon.

The IDF fielded a mechanized, technologically advanced, casualty sensitive first world army against both conventional (Syrian) and unconventional (PLO) opponents in a media-saturated, third world urban environment. The PLO was well-financed and well-armed guerilla organization equipped with Western and Soviet Bloc small arms, antitank weapons, artillery, mortars, and a few old tanks. The Syrian army was a conventional force equipped with Soviet equipment. The IDF employed nine heavy divisions and planned to move rapidly through and bypass resistance; follow-on forces reduced by-passed enemy strongpoints.

Tyre, the southernmost of the three cities, lies on a peninsula, with densely populated PLO camps inland to the east.

- One IDF division was employed. It surrounded Tyre on the first day. Its attack commenced on multiple axes, including an amphibious landing. Struck with surprise and mass, the PLO fell back. Then, the IDF began to clear PLO camps slowly. The remaining PLO positions were isolated and reduced with infantry, direct fires from tank and self-propelled artillery, indirect fires, naval gun fire, and close air support.
- Initially, infantry advanced in M113 APCs, but were successfully ambushed by PLO anti-tank teams. The IDF quickly adapted, moving infantry forward on foot, with APCs ferrying supplies forward.
- There were civil affairs and psychological operations failures. Civilians were warned to move to the beach, but there were no plans to care for them. Large numbers of refugees left the city, masking PLO movement and ambush sites.

Sidon is a large coastal city that allowed an amphibious assault to complement overland and air operations.

- The Israelis employed three divisions with one in an amphibious approach. Again, the attack was rapid and from multiple directions and followed by deliberate clearing. The Israelis subdivided enemy positions and reduced them with direct and indirect fires.
- PLO resistance was sporadic but fierce. Civilians masked positions and movement.
- Infantry led the penetration of the city, with tanks supporting. Self-propelled artillery and close air support aircraft also provided support. The Israelis cleared the city in two days.
- Penetration of the camps, however, was led by tanks. Inside the camps, infantry led. The PLO continued resistance for five days.

Beirut was the largest of the three cities, spanning 50 square kms with over one million inhabitants. Like, Tyre, it is a peninsular city with modern skyscrapers. Beirut housed between 10 to 15 thousand PLO and 2 to 5 thousand Syrian troops. Fighting lasted three months.

- The Israelis employed a divide and conquer strategy (salami slice) to force the PLO into increasingly smaller areas. Only known PLO areas were attacked. First, the Israelis isolated, then attacked these areas with company-sized teams of infantry, tanks, and self-propelled artillery, CAS, and indirect fires.
- In Beirut, the IDF placed greater reliance on fires than on building-to-building clearing by infantry. It limited fires to PLO-held areas. Infantry advanced after PLO positions had been isolated and then saturated by fires.
- There was an early fight between Israeli and Syrian forces for the major east-west route out of Beirut to Damascus. Control of the highway kept Syrians at bay and allowed the IDF to concentrate on PLO strongholds.

The PLO left Lebanon, but Israel continued to occupy a buffer zone between Lebanon and Israel at the time of the article.

OPERATION RIO: TAKING BACK THE STREETS

Mendel, W.W.
"Operation Rio: Taking Back the Streets"
Military Review
May-June 1997
Pages 11+

This article reviews the actions of the US military in the 1992 Los Angeles Riots and the Brazilian Armed Forces in countering criminals in Rio de Janeiro in 1994-1995. The author states that lawlessness and organized crime have become necessary components of national security planning and analysis. Criminal activity is woven into many security threats such as: weapons proliferation, drug trafficking, terrorism, insurgency, and illegal immigration.

The 1992 Los Angeles Riots lasted five days, killed 54 people and caused an estimated $700+ million dollars damage. National Guard troops deployed on the second day. Civilian leaders viewed the Guard's deployment as too slow. However, much of that delay came from a late order. The Guard ultimately deployed 10,465 troops to Los Angeles. By the third day the Guard troops were federalized and federal troops began showing up. The actual number of federal troops was not that large, but sufficient to put a federal officer in charge of Joint Task Force-Los Angeles.

Once federalized, the Guard troops became less responsive in support of law enforcement agencies. The cause was the Posse Comitatus Act, which was intended to exclude regular military forces from domestic police activities. It does not apply to Guard forces operating under the command of a state governor. The JTF-LA chain of command applied a test to all requests for assistance from law enforcement agencies to check for compliance with the Act. This proved an unnecessary constraint, as the Act does not necessarily apply in cases of unexpected civil disturbance.

There were problems with both rules of engagement and leadership. The incoming Federal commander ordered more restrictive rules of engagement on day four. When questioned by forces in the field, the chain of command replied that the rules of engagement should not be interpreted literally. This reflected a failure to confront the difficult issues associated with urban combat in a peacetime environment. The politically charged interagency environment affected the quality of direction given by civilian leaders to the military.

The lessons learned from the 1992 riots were: trained civilian leaders are critical to success, plans and exercises should include all potential contributing parties, the troops need better radios for the urban environment, the troops need better protective gear, and non-lethal means are needed.

From November 1994 to January 1995 the Brazilian military conducted Operation Rio in Rio de Janeiro a city of 12 million people. The mission was to take back control

of the 4 to 5% of the city's ghettos controlled by criminal gangs. These gangs had won over the local population by distributing food, medicine, and money, where state services had failed. Police in these areas were unmotivated, ineffective and often in league with the gangs. By 1994, the level of violence throughout the city had reached a level that the political leadership of Brazil decided to act through military force.

Planning was guided by several restrictive imperatives established by the Federal Government. These factors became a foundation for concepts of operations and the tactical rules of engagement later issued to the troops.

- *Maintain Institutional Normalcy*: The legal environment surrounding the operation would be kept as close to normal as possible. No significant new restrictions would be put upon the civilian population and the military would act in a police-like role. A special emphasis was placed on maintaining the reputation of the Armed Forces by avoiding innocent civilian casualties.
- *Limited Time-frame*: The operation was to have a short three-month duration. Then control of contested areas would revert to the local government to minimize the loss of combat readiness by military units.
- *Sustain Legitimacy*: An important measure of success would be an increase in popular support for the local government.
- *Lack of Information*: The local police had not established a useful criminal intelligence system. The military had to develop its own interagency intelligence system.

Unity of command was achieved when the Brazilian President and State Governor placed the Federal and State Police elements under the military's control. The operation was composed of three overlapping phases: isolate, police, and combat. The isolate phase was designed to cut off the gangs from both their outside sources of contraband (mainly drugs) and their customer base in the city. The police phase involved aggressive patrolling in high-crime areas. The combat phase focused on confronting gang strongholds. These areas were often encircled and then searched building by building.

The results of the operation were remarkable. While conducting the operation under intense media scrutiny polls showed a 90 percent approval rating among the populace. Throughout the operation no innocent bystander was injured or killed. Later in the operation the intelligence effort received a major boost as citizens began calling in information on the police hotline. One downside was that the main "drug lords" did manage to get out of the city before the operation got underway.

BRADLEYS IN THE CITY

Miles, J and Shankle, M.
"Bradleys in the City"
Infantry
May-June 1996
Pages 6-8.

"Bradleys in the City" documents lessons derived from training a US Army mechanized infantry company at a MOUT site in Germany. A mechanized infantry company includes 14 M2 Bradley Fighting Vehicles (BFVs): three platoons of four BFVs each and one BFV each for the company commander and the executive officer. The authors' experience includes assignments as company commander, platoon leader, and other positions in Company C, 1st Battalion, 15th Infantry. The company's training included three phases: gaining an initial foothold in a city, moving tactically through a city, and establishing and securing a company-sized assembly area in a city.

The article assumes that the initial foothold in a city would be a building. Reconnaissance determines which building. BFVs deliver the assault force. The remaining BFVs support the assault by fire on the objective and adjacent buildings. The firepower of 14 BFVs was effective in isolating and suppressing buildings for the initial foothold. Diagrams indicate adequate fields of fire for 10 BFVs abreast with the other BFVs in the assault. Rather than a large assault force in the field, the authors argue that initial contact should occur with the smallest element possible, as is the standard in wooded terrain.

Movement through the city occurred with infantry deployed ahead of and behind each BFV. A six-man forward security element led, and a 4-man track security element followed. The basic battle drills for BFVs remain relevant but must be generalized from the ground plane to span positive and negative elevations.

The authors also discuss occupying and defending an assembly area. The defense was designed to exploit buildings, streets, and alleys. The defense was based on three platoon strong points inside buildings, BFVs covering vehicle avenues of approach, and infantry conducting security patrols. Because of the small number of approaches, many BFVs were positioned inside buildings or otherwise under cover.

The replacement of the M113 armored personnel carrier with the M2 Bradley fighting vehicle saw a significant decrease in manpower and gained firepower. The authors note that urban operations are manpower intensive. BFVs don't enter, clear, and hold buildings. The vulnerability of the lightly armored vehicles is a common theme in other articles based on real world operations, but not addressed by the authors. The company was pure, the typical organization in garrison, not the typical tank and mechanized infantry company team found in combat. The article leaves unanswered the question of whether or not the Army is planning on fighting with pure mechanized infantry in urban operations.

BOTTOM LINE: IT'S INFANTRY

Packard, S.E.
"Bottom Line: It's Infantry"
Proceedings
November 1998
Pages 28-31.

This article focuses on the doctrine and organization of the US military relevant to urban OOTW. The author states that urban operations emphasize the employment of infantry, while reducing the effectiveness of aircraft, tanks, artillery, and technology. Because the urban environment limits mobility, communications, and fire support, traditional US advantages are reduced. Dominant battlespace knowledge is not credible in the urban environment. However, US doctrine has not kept pace with the needs of urban combat.

Several social forces are driving combat to the cities. As wealth and power gravitates to cities, power seekers have focused on the cities to gain legitimacy and infrastructure. As urbanization continues to grow unabated it breeds a disenchanted constituency ripe for subordination. With the advanced surveillance systems in the US inventory the best place for a foe to hide is in plain sight, among the masses of people in a city. The presence of noncombatants also will cause US forces to be restrained in the use of firepower.

There must be doctrine not only to deal with the challenges of the urban environment, but also to handle the range of potential operations. Doctrine focuses on an abstracted enemy while in OOTW the focus is on the people. For a mission to have legitimacy, both the US public and the locals where the mission is taking place must approve of the mission. Apparent disregard for local political sovereignty, apparent disregard for the local territorial integrity, and or excessive civilian casualties can erode public support.

Marines are taught to rely on combined arms. Unfortunately, the combined effects of OOTW, urban terrain, and the actions of the enemy will strip away the synergistic effect of integrating multiple combat arms. Tanks are death traps in urban combat, as evidenced by Stalingrad and Grozny. Anything other than direct-fire weapons may have marginal value. The only indirect-fire weapons that will have widespread utility are those that can make sharp course corrections while in flight (i.e., 90° around a building). Aircraft are too vulnerable and incapable of delivering precision fires in the urban environment.

Stripped of the support of combined arms the infantry must adapt with innovative tactics and flexible organization. To interface with any area's inhabitants US forces must establish a *continual* presence. Time on the ground builds the relationship with the locals, which pays HUMINT dividends. It also makes possible pattern recognition allowing for a "heads up" when changes are forthcoming. Dispersed infantry operations facilitate rapid convergence to a hot spot, a tactic used quite effectively by the Somalis in 1993. There are risks with dismounted infantry movement in the city. However, dismounted infantry does not have to move down restricted streets where the primary

killing zones are. They can move building to building, following the urban guerillas wherever they go.

Current military communications are inadequate for urban operations. Given the conditions likely in the city the best course of action is to teach Marines to act autonomously. Operations on the dispersed urban battlefield call for new organizational structures. One interesting model for organizations that face dynamic environments is called a "command network." In a command network the organizational structure changes with each situation, depending on the specific task and overall mission. Its effectiveness depends on collecting all the data possible, appropriate analysis, and passing the data to the lowest level possible. Command networks depend on high levels of cross-department communication. The bottom line is that infantry operating with flexible organizational structures can maintain a legitimate presence in urban OOTW.

THE HUMAN TERRAIN OF URBAN OPERATIONS

Peters, R.
"The Human Terrain of Urban Operations"
Parameters
Spring 2000
Pages 4-12.

In "The Human Terrain of Urban Operations," Ralph Peters argues that the human characteristics of an urban area are as important to warfighters as the city's physical characteristics. Focusing more on peacekeeping operations than combat operations, Peters identifies three types of cities:

- *Hierarchical cities* characterized by a broadly accepted chain of command and rule of law. In exchange for some civil responsibilities (e.g., taxes, standards of public behavior), the citizenry expects certain protections and services. This is the traditional form of the city. In terms of military operations, Peters believes that hierarchical cities "…can provide bitter prolonged resistance to an attacker. Paradoxically, they can be the easiest to govern once occupied if the population recognizes its interests lie in collaboration."
- *Multicultural cities* are cities in which "…contending systems of custom and belief, often aggravated by ethnic divisions, struggle for dominance." In these cities, contending groups struggle at weighing the balance of power in their favor. Peters uses Jerusalem as a prime example of a multicultural city. With regards to military operations, Peters believes that "…multicultural cities can be easy to conquer—with the aid of oppressed minorities as a fifth column—but difficult to administer after peace has been established." Peacekeeping often becomes a constant struggle to appease competing groups, thus drawing the occupiers into ethnic and cultural arguments not easily resolved.
- *Tribal cities* are cities in which differences rest in blood (tribes) instead of race or religion. Peters contends that urban areas draw impoverished young males from outlying areas. This influx of a volatile population bound by blood makes conflict resolution difficult if not impossible. This type of environment provides the peacekeeper with several challenges: 1) difficulty in differentiating between the warring parties, 2) difficulty in collecting intelligence on clans and tribes, 3) clan and tribal hatreds are usually deep-seated and difficult to resolve.

Peters concludes by noting that this taxonomy provides the military professional with a "crude framework" for thinking about the challenges of operating in urban environments. He ends with the observation that "…the center of gravity in urban operations is never a presidential palace or a television studio or a barracks. It is always human."

OUR SOLDIERS, THEIR CITIES

Peters, R.
"Our Soldiers, Their Cities"
Parameters
Spring 2000
Pages 43-50.

In "Our Soldiers, Their Cities," Ralph Peters contends that urban operations are an unavoidable aspect of future military operations. He further contends that the US military, as currently structured, is grossly unprepared for operating in the urban environment. The article then proceeds to list and describe several different facets of military operations in urban terrain that need consideration before the US military operate effectively within the urban environments of the next century. Some of the facets requiring consideration and resolution include:

- *The nature of urban warfare*. Peters notes that military organizations prefer horizontal conflicts (e.g., fighting on the plains of Europe in a Third World War) whereas urban operations are decidedly vertical (i.e., extending above and below the street). This difference will complicate military operations through the separation and compartmentalization of military forces. Furthermore, the existence of large and often segmented civilian populations will also complicate urban operations.

- *The organization and equipment of military units*. Peters contends that urban operations will be manpower intensive (which runs contrary to the US preference for advanced technologies performing human functions) and will require enhanced medical and communication capabilities, more effective weapon systems (e.g., personal weapons, shotguns, personal thermal imagery systems), and innovative combat units (e.g., sapper platoons in infantry battalions). While Peters believes infantry will play a central role in urban operations, he also believes that there is a need for direct fire capability at the tactical level as well as a means of moving infantry and supplies rapidly and safely through hostile environments.

- *The role of intelligence and civil affairs*. Intelligence and civil affairs, often perceived as under-appreciated aspects of military organizations, will play an increasingly important role in urban operations. Intelligence professionals will perform a variety of tasks and need to enhance their human intelligence capability. Civil affairs and psychological operations will merge with the intelligence capability to improve their efficiency and effectiveness.

- *The need for discipline and training*. The urban environment is full of stressors and distractions. As such, future warfighters will need to be extremely well-disciplined, in superb physical condition, and capable of making sound decisions.

> Peters recommends that the leader-to-led ratio be increased at the tactical level to ensure the maintenance of discipline and sound tactical decisionmaking.

Peters then closes with some recommendations that the US Army could implement to improve its ability to operate in urban environments.

MOUT: THE SHOW STOPPER

Podlesny, R.E.
"MOUT: The Show Stopper"
Proceedings
January 1998
Pages 50-54.

This article contrasts the demands of the urban combat environment with the concepts described in *Joint Vision 2010*. The author sees four primary challenges to JV2010 from MOUT.

- *Command and Control*. The technical and operational roadblocks to attaining the level of battlespace knowledge demanded by JV2010 are formidable. Current look-down radar and moving-target indicators work poorly in the urban canyons. Today's ISR assets do not distinguish hostile from neutral civilians. Dispersed units will be difficult to control when buildings block GPS and radio signals. Comprehensive data bases need to be built on urban geography.
- *Precision Fires*. Today's arsenal contains many weapons with arching flight trajectories of limited value in cities with multi-story buildings. GPS guided munitions could have their signal blocked by taller buildings. Weapons effects and penetration capabilities need to be reconsidered.
- *Maneuver*. Land vehicles will have to contend with rubble and craters in roadways. Helicopter will have to contend with swirling and unpredictable air currents around buildings.
- *Logistics*. A major supply problem will be in dealing with the needs of the noncombatants masses. Rearming a variety of widely distributed units within a megacity may have to be addressed by caching or other innovative means.

An operational baseline of today's capabilities should be established to design and build future forces. Support tools and training need to be improved. The training of small unit leaders needs to be revamped as their role is paramount in urban operations. Training areas are too small and fail to replicate major urban areas.

URBAN WARFARE: OPTIONS, PROBLEMS, AND THE FUTURE

Press, D.G.
"Urban Warfare: Options, Problems, and the Future"
Marine Corps Gazette
April 1999
Pages 14-18.

This article was extracted from a report on a conference sponsored by the MIT Security Studies Program held in 1998 at Hanscom Air Force Base, Massachusetts.

The first question to ask in regards to urban operations involves their inevitability. Advocates of increasing American MOUT capability see future US leaders, regardless of strategic wisdom, ordering US troops into urban areas. Therefore, US urban capabilities must improve. Critics of improving MOUT capabilities see a better approach as educating US leaders as to the risks and difficulties associated with urban combat. A second question relates to technology's potential in the urban environment. Can US forces replicate in cities the dominance they have achieved in open terrain? A third question deals with alternatives to urban combat.

In dealing with these questions one can divide urban operations into three types: policing operations, raids, and sustained combat. The contention that urban policing operations have and will occur frequently holds true in this case. With proper training and equipment US forces should be able to police cities with low casualties.

Conducting raids is a more difficult proposition, but within the realm of possibility. The two biggest obstacles to most raids are intelligence and insertion/extraction. Improving intelligence capabilities may be the best way to improve the prospects for urban raids. Training and equipping US forces to operate effectively at night can best deal with the insertion/extraction problem. With investments in superior doctrine, training, and technologies, substantial military advantages can be achieved for urban raids.

Sustained urban combat is the most difficult and least likely type of urban operation. US forces have not been involved in sustained urban combat for three decades. America is unlikely to tolerate high military and civilian casualties that would accompany full scale urban combat unless the national interests at stake were large. A better alternative would be to establish a loose cordon around the city, while cutting off utilities to encourage desertion and rebellion by the populace against enemy forces. It is easy to think of scenarios in which US decision makers would want a city retaken quickly, but it is difficult to think of one where that attack would justify the costs and collateral damage.

There are often more attractive alternatives to sending US forces to fight in the cities. Humanitarian assistance can often be both cheaper and more effective in helping people overseas. The so-called "CNN Effect" of public outcry forcing interventions is overrated.

[PRESS 1999]

In sum, US forces should prepare for urban policing and raid missions, but they should not prepare for unlikely and costly sustained urban combat.

CITY SLICKERS BECOME TARGETS OF FUTURE MARINE CORPS OPERATIONS

Reed, F.V.
"City Slickers Become Targets of Future Marine Corps Operations"
Signal
July 1998
Pages 49-53.

This article reviews the efforts of URBAN WARRIOR, a 14-month series of battle experiments conducted by the Marine Corps Warfighting Laboratory. The goal was to test tactics and technology specifically tailored for the urban environment.

The Warfighting Laboratory wants to avoid the historical approach to urban combat, one in which the city is cleared building by building in a slow and costly linear sweep. In order to win without heavy losses, Marine leaders need to have a wide variety of intelligence information. Laboratory officials believe that the tactical key is decentralized control of troops.

An important element in decentralized operations will be inexpensive short-range radios that would allow lower-level commanders to communicate directly with each other. The Laboratory is relying heavily on commercial available communications equipment to reduce costs and shorten acquisition cycles. Normal military acquisition times are far too slow to take advantage of rapid changes in many of the technologies useful for C^4I in the commercial sector. One Marine officer argued, "We want to be able to buy new communications equipment about every three years at the bottom of the pyramid."

Another difficulty facing the Marines involves current equipment that is often ill suited for urban combat. Tank ammunition works poorly against buildings and most shoulder-fired rockets emit too much back blast to fire safely from inside a building. One unusual solution is Dragon Fire, an unmanned 120 mm mortar. It was relatively inexpensive to develop and can fire 10 rounds per minute from a 32-round magazine. The weapon has its own GPS receiver and a squad leader can exercise remote control if needed. Another weapon being considered is a fiber optic guided missile. This weapon could be flown around buildings on the way to targets while providing a camera view back to the person controlling its flight.

MARINES SEEK NEW SOLUTIONS TO SECURE THE URBAN ARENA

Reed, F.V. [Reed 1999]
"Marines Seek New Solutions to Secure the Urban Arena"
Signal
June 1999
Pages 99-102.

This article reviews the Marine Corps efforts on MOUT through its *Urban Warrior* exercise. The author states that because future foes will not directly challenge US military forces in the open, they will seek arenas that limit the US military advantages. Cities could serve that purpose.

The *Urban Warrior* exercise, begun in 1997, sought to find solutions to urban combat before marines need them in actual combat. To economize, commercial off-the-shelf (COTS) equipment was used where possible. With its purpose to test concepts, *Urban Warrior* made extensive use of simulation. In one exercise, a helicopter was outfitted to simulate a future UAV. Non-lethal weapons that could incapacitate those in a building were also examined as a long-term alternative to room-to-room fighting. Quick-hardening rigid foam was under consideration as a future technology. Its use would allow the quick sealing of rooms, sewers, and subways. Blue-on-blue engagements were another concern. By improving situational awareness, the Marines hope to reduce friendly-fire incidents. By improving the use of computers, they hoped to reduce the size of headquarters units. Some of the solutions were decidedly low-tech. New gray uniforms with a brick-like pattern blend in much better than the standard green. Knee and elbow pads allowed troops to crawl on concrete without injury.

THE CHECHEN WAR: PART III

Reed, J.
"The Chechen War: Part III"
Red Thrust Star
October 1996
http://call.army.mil/call/fmso/red-star/issues/oct96/oct96.html#chechen.

Russian ground force commanders learned much while conducting operations in Chechnya. At upper levels, after-action assessments focused on the need to implement changes in tactics for urban combat, combat reconnaissance, and military-civilian interaction.

While Soviet history from World War II is filled with urban victories, the Russians seem to have forgotten much of what they learned. Chechen snipers greatly hampered Russian forces. In future urban operations, one can expect to see a greater number of Russian snipers and counter-snipers. Other likely changes to tactics include creation of an armored advance force and the creation of urban reconnaissance teams.

Russian air operations also performed poorly. One problem was inferior quality munitions, such as rockets fired from Mi-24 attack helicopters. Their motors would often fail to ignite and they would fall straight down onto friendly forces. The training level of the pilots was weak, and they were not prepared to function under fire. Unsecured radio links made ground units unwilling at times to give their position to friendly aircraft. This contributed to the inaccuracy of air strikes.

THE BATTLE OF GROZNY: LESSONS FOR MILITARY OPERATIONS IN URBANIZED TERRAIN

Rupe, C.
"The Battle of Grozny: Lessons for Military Operations in Urbanized Terrain"
Armor
May-June 1999
Pages 20-23, 47.

Captain Chad A. Rupe describes the "road to war" and the aftermath of the battle of Chechnya between December 1994 and February of 1995. Many of the lessons are not unique to warfare in urban settings, including poor intelligence, poor leadership, and hubris. Perhaps most important was the misidentification of the rebel leader rather than the Chechen farmer's plight as the center of gravity. That is, confusing conventional warfare with insurgency warfare.

Chechnya is home to two ethnic groups, the Ingush and the Chechens. Ethnic Chechens wanted independence from Russia, while the Ingush wanted more autonomy within the Russian Federation. Yeltsin openly backed the Ingush against the Chechens in a civil war from 1991 to 1996. The Ingush attacked Grozny, the capital of Chechnya, in November 1994, backed by Russian advisors and air power, but the attack failed. Russia then responded to the defeat with a three pronged attack against Grozny in December 1994. The final objective was the Presidential Palace and the rebel leader. The main effort came from the north, with supporting attacks from east and west. The advance from the west was thwarted by civilian blockades. The northern force penetrated the city without waiting for supporting forces.

The Chechens defended in three concentric circles around the Palace. The outer perimeters on the city outskirts and the middle perimeter 2 to 5 km from the palace were formed of strong points. The inner perimeter, about 1.5 km from the palace employed prepared positions and tank and artillery fire.

Russian intelligence preparation was abysmal. The Russians misgauged the center of gravity to be the rebel leader rather than the Chechens. They did not even possess adequate maps of the city. Perhaps as important as the intelligence failures, or as a result of them, the Russians expected poorly trained civilian mobs to collapse without a fight. Guns were unloaded and troops were sleeping in the back of APCs during the attack.

The Chechens formed hunter-killer teams of three to four men each. Killer teams were composed of an antitank gunner with RPG, machine gunner, ammunition carrier, and sniper. These teams formed into groups of 15 or 20 fighters. Each group followed a Russian column through the city. Scouts (hunters) communicated with infantry (killers) over hand-held radios to set up ambushes. Destroying the first and last vehicle in the armored column then allowed the Chechens to destroy the remainder of the column.

The Russians began operations with superior numbers, 24,000 troops to 15,000 and 80 Russian tanks to 50 largely non-operational Chechen tanks. The Russians quickly learned that armored columns were easily defeated and formed combined arms teams of a tank, two fighting vehicles, and infantry to clear buildings. Indirect fire support from artillery and mortars was provided at the battalion level.

Approximately 25,000 Russian soldiers, rebels, and civilians died in the battle of Grozny. The death of the rebel leader did nothing to stop the fighting. Russian special police raped, murdered, and molested villagers, increasing the Chechen will to fight. Even after the Russians declared victory, the civil war continued.

The author recommends a company team formed around a mechanized infantry or tank company augmented by an additional tank section, leg infantry platoon, mortar section, combat engineer vehicle, and sapper platoon. He also suggests tactics, techniques, and procedures to deal with the problems of high and low angle of attack and adjacency of moving forces to occupied buildings.

He also stresses the importance of integral engineering assets. Engineers are needed to breach obstacles that form ambush sites. They are also needed to create new routes for maneuver and evacuation.

The ability for infantry, at the platoon level, to talk to commanders of armored vehicles was stressed. The author also recommends for increased training in urban warfare for mortar sections due to the smaller impact on the civilian population than other means of indirect fire.

THE INDIRECT APPROACH

Scales, R.H. Jr.
"The Indirect Approach"
Armed Force Journal International
October 1998
Pages 68-74.

In "The Indirect Approach," General Robert H. Scales, Jr., Commandant of the US Army War College, asserts that rather than engaging enemy forces in urban areas, the US would be better off to isolate the city and let it "collapse on itself." In support of a renaissance for siege warfare, Scales contends that the human cost of operating in urban environments is a burden that neither the American government nor people will bear. By isolating cities and using time to advantage, Scales contends that US forces can bring about the collapse of an enemy without suffering unnecessary or unacceptable casualties.

Scales believes that future adversaries will try to minimize American combat effectiveness by using two strategies. The first involves a rapid military campaign to seize limited objectives, immediately followed by diplomatic maneuvering, which will attempt to impede and delay a US/coalition response. The second strategy, which might occur in conjunction with the first strategy, will have the enemy dispersing his forces within an urban area and settling in for a protracted, attrition-based campaign. Such a strategy would minimize US tactical mobility and combat effectiveness and play on casualty-aversion myth.

To counter the second strategy, Scales advocates the indirect approach—a strategy of isolating a city, using time to weaken the enemy's combat effectiveness and using stand-off capabilities to engage the enemy—over the direct approach advocated by many within and without the Department of Defense. Once isolated, the population would be urged to leave. US and coalition forces would give former residents of the city safe passage to refugee camps. Scales asserts that the remaining population would then become a refugee burden for the occupying force. Eventually, a lack of supplies and popular support would bring about enemy capitulation. Thus the indirect approach would enable the United States to achieve its strategic objectives without the risk and cost that is associated with urban warfare.

Scales concludes with the caveat that the indirect approach will not always prove effective because of levels of popular support, pain and suffering thresholds, the amount of stored goods, the ability to seek respite elsewhere, etc.

DON'T GO DOWNTOWN WITHOUT US

Schwartz, N.A. and Stephan, R.B.
"Don't Go Downtown Without Us:
The Role of Aerospace Power in Joint Urban Operations"
Aerospace Power Journal
Spring 2000
Pages 3-11.

The authors begin by stating that not all urban operations involve infantry intensive house-to-house fighting. The urban fight is a "joint fight," and a one-size-fits-all approach to the problem is a recipe for disaster.

The classic view of MOUT is that it negates traditional US military advantages. Proponents of this view see it as manpower intensive, mostly close quarters combat, requiring the use of low-tech solutions, and relegating aerospace aspects to a supporting role. Some "high-end" scenarios may warrant the political risks and human costs inherent in such an approach. However, most conflicts in urban areas will fall short of this mark, making such an approach an unrealistic military option.

A competing school sees the city as a system of critical nodes that US forces can identify and destroy using aerospace assets. By making these nodes the focus of operations, US forces can match their strengths against the enemy's centers of gravity without having to close. The authors then lay out a hypothetical concept of operations:

- *Battle-Space Analysis*. An important component of the concept, battle-space analysis encompasses intelligence preparation of the battlespace and maintenance of operational-level situational awareness. This view would come from a combination of space-based systems, manned and unmanned aerial vehicles, human sources, and archived data.
- *Isolation*. This involves physically and psychologically separating an adversary from his urban support base. Associated with this would be the limiting of the foe's mobility, communications, and intelligence efforts. Isolation also implies the physical protection of the populace from enemy attack, exploitation, and collateral damage.
- *Decisive Engagement*. Aerospace power is absolutely pivotal in this component. In the future, tactical strike aircraft will be more closely tied to UAV sensors.
- *Sustainment*. Sustaining the momentum of decisive-engagement operations will come from continual real-time analysis of the battle space, effects against key nodes, reinforcement, and logistical support to committed forces.
- *Transition to Peace*. The destruction of weapon stockpiles, the monitoring of activities of warring factions, the introduction of peacekeeping forces, and the

transition to civil authority can all contribute to the enemy's defeat. Strategic and tactical lift capabilities are integral to urban peacekeeping operations.

CONDUIT OR CUL-DE-SAC?

Smith, M.M., and Hofstetter, M.
"Conduit or Cul-de-Sac? Information Flow in Civil-Military Operations"
Joint Forces Quarterly
Spring 1999
Pages 100-105.

In "Conduit or Cul-de-Sac? Information Flow in Civil-Military Operations," authors Michael M. Smith, a lieutenant colonel in the Army Reserve, and Melinda Hofstetter, a major in the US Marine Corps, assert that better relations between civil organizations and agencies (e.g., NGOs, PVOs) and military institutions (specifically at the battalion and brigade-sized units) must improve, if the military's performances in civil-military operations (CMOs) and military operations other than war (MOOTW) are to be more effective.

The authors contend that the increasing frequency of CMO and MOOTW requires a different approach to warfare; one in which warfare "…transcend[s] material destruction of property and populations to deal with the underlying economic, sociological, religious, and ethnic issues of society at large [p. 101]." To address these objectives, military organizations must coordinate with civilian agencies to realize a unity of effort and must be willing to share information. The challenge lies in overcoming the military's misunderstanding of NGOs, which are frequently perceived as "an uncontrollable yet monolithic block of tree-huggers [p. 103]." Rather, the military must understand that each organization has its own goals and motivation and should be engaged in a coordinated and focused manner.

Furthermore, the authors contend that the nature of NGOs—using relief workers to address specific and enduring problems—can serve as a major source for the collection of intelligence and improvement of situational awareness. Such a benefit is not without cost: the military must also share information with the NGOs. While there are several challenges to the realization of this type of information flow (e.g., NGO's frequent distrust of the military, interoperability, language), it can frequently be achieved through initiating personal relationships at the "worker" level.

Finally, the authors note that the military ought to monitor and exploit existing information sharing networks (e.g., government agencies, NGOs, media, public gathering locations) to gain information on and assess the situation in the area of operations.

CREATING TECHNOLOGY FOR KICKING IN THE DOOR

Steele, D.
"Creating Technology for Kicking in the Door"
Army
January 2000
Pages 31-36.

Author Dennis Steele observed training exercises at the McKenna MOUT site at Fort Benning, Georgia. The exercises were part of the MOUT Advanced Concept Technology Demonstration (ACTD) program. Urban combat is considered one of the most dangerous battlegrounds for the Army because it neutralizes US maneuver advantages and limits the use of firepower because of fear of collateral damage.

MOUT ACTD, a joint development project, seeks to preserve the US technological advantage in the urban environment. The program began in February 1998 with the first of ten separate service experiments, six by the Army and four by the Marine Corps. The requirements fall into the functional areas of C^4I, engagement, force protection, and mobility. Most of the equipment being tested is low-tech. The deputy MOUT ACTD division chief stated, "Just because a piece of equipment is not particularly high tech does not mean that it will not be a formidable addition to the inventory."

ENGINEERS, ARMY AFTER NEXT, AND MILITARY OPERATIONS IN URBAN TERRAIN

Stewart, J.
"Engineers, Army After Next, and Military Operations in Urban Terrain"
Engineer
March 1999
Pages 17-19.

Mr. Stewart, a military engineer development analyst with the US Army Engineer School, sees engineering units as critical to the urban fight. During *Army After Next* war games, one phenomenon emerged a number of times. To avoid certain defeat by the AAN strike force, the enemy retreated into the cities. The AAN operational tempo promptly collapsed and the initiative went over to the enemy.

Future MOUT operations are likely to include many of the same deliberate, slow, and painstaking tasks performed historically. These have been: clearing rubble, demolition work, creating breaches in structures, and repairing infrastructure. Engineers can and should increase their role in MOUT. Doctrine could be expanded to include:

- Using information technologies to better visualize the three-dimensional urban battlespace,
- Precise modeling of material strengths for weapons effects and mobility (e.g., rooftop landings),
- Rapid, nonexplosive breaching of walls and obstacles,
- Autonomous or remote mine clearing, and
- Restoring infrastructure services and denying their use to the enemy.

Operation Just Cause in Panama offered a number of lessons learned for engineers:

- Engineers need realistic and live-fire MOUT training opportunities,
- Engineers should have employed counter-mobility efforts in the sewers,
- Claymore mine employment in the city should be improved,
- Stairways should have been removed to hamper enemy movement inside of buildings, and
- Engineers should have reinforced ground floor areas to provide improved blast protection.

COUNTERINSURGENCY IN AN URBAN ENVIRONMENT

Strader, O.K.
"Counterinsurgency in an Urban Environment"
Infantry
January-February 1997
Pages 8-11.

"Counterinsurgency in an Urban Environment" provides a handful of lessons collected from a variety of sources, including operations in Somalia and Panama. The author, Captain O. Kent Strader, has served with 2d Battalion, 505th Infantry, 82d Airborne Division and as a trainer for the Infantry Officer Basic Course.

Perhaps the strongest theme in this article is the importance of intelligence gathering at the individual soldier level.

- Urban conflict places civilians, regulars, and guerrillas together on the battlefield, thus complicating the rules of engagement and demanding training that includes large numbers of neutrals to complement the opposing force.
- The author argues that the individual soldier must be part of the intelligence gathering mechanism. Patrols amidst the local populace will need to be conducted to establish good will and detect changing patterns of behavior.
- Intelligence gathering is an individual soldier skill that needs development during standard training. After the initiation of hostilities during *Operation Just Cause*, a methodical search began for weapon caches and for Popular Defense Forces. Patrols were expected to gather and report intelligence information.
- Snipers may be incorporated to conduct surveillance and effect surgical kills on threats as they emerge.

The article has limited discussion of information technology, but does mention that at battalion level, remotely monitored battlefield sensor system, low-level voice intercept, and ground surveillance radar can augment the intelligence gathered from patrols. "Still, the subtleties of operating in urban terrain will make using these assets more of a challenge to operators and commanders."

The author also cites equipment shortfalls, including the need for a shotgun incorporated at the lowest tactical echelons. The shotgun is needed to breach doors and dispense crowd control agents. Its short range reduces the risk of non-combatant casualties.

The article has other implications for training.

- *For CSS.* The "frontless" urban environment requires CSS units to immerse themselves in the same environment as the infantryman. Therefore, they must be

trained in marksmanship, response to ambushes, and operations under riot conditions.

- *For Infantry.* Currently, special operations forces are trained and equipped for the kind of close quarter drills that take place inside buildings. For urban operations, regular infantry will need similar training and equipment.
- *Equipment.* Common tools, like the flash/bang grenade used to precede entry into a room, is not commonly part of standard training.

This article, like others, argues for the full integration of combined arms at the lowest tactical echelons. Engineers have a strong roll to play. They built obstacles to canalize movement toward fortified checkpoints, and were required to relocate checkpoints overnight. The 2^{d} battalion, 87th Engineers used "speed wiring" to cordon off portions of Kismayu in Somalia by driving a truck around the block designated for search, trailing rolls of concertina fence around the area in 15 minutes, allowing infantry to concentrate more on search than on cordon. Military Police were also integral to urban operations. They were instrumental in crowd and riot control and for searching cars for bombs, etc. The M1A1's armor and machineguns (not its main gun) were mentioned in passing. Its exhaust heat proved useful in dispersing crowds. The M551 Sheridan, a lightly armored, tracked gun system, also had a strong "presence factor." Light helicopters are useful at battalion level for overhead surveillance and for troop insertion on roofs.

AIR OPERATIONS IN LOW INTENSITY CONFLICT

Thomas, T.L.
"Air Operations in Low Intensity Conflict: The Case of Chechnya"
Airpower Journal
Winter 1997
Pages 51-59.

In "Air Operations in Low Intensity Conflict: The Case of Chechnya," author Timothy Thomas, a retired US Army lieutenant colonel and analyst at the Foreign Military Studies Office, examines the limited effectiveness of air power in low intensity conflicts. His thesis rests on a statement by General Charles Boyd, USAF (ret.)[2] and examines Boyd's argument in the context of Russian operations in Chechnya. The article then examines two specific aspects of the air war over Chechnya: Russian tactics and operations and an assessment of rotary wing and fixed wing effectiveness in low intensity conflict.

In the early phases of the 1994 campaign, the Russian military struck at Chechnya's limited air capability to preclude its use against Russian military targets or its use as crude guided missiles (e.g., *kamikaze* aircraft). Russia also used its air force to prevent the Chechens from establishing air bridges with other countries. In spite of these relatively effective operations, the Russian air force was the subject of severe criticism. Despite near complete air superiority (the Russians encountered a sporadic and relatively unsophisticated air defense capability), the civilian-to-"rebel" death ratio remained fairly high (approximately 8:1). Furthermore, many critics said the Russians learned little from Desert Storm as they had focused on the Chechen air force over command and control nodes, communications nodes, and important nodes in the infrastructure. To the Russians' credit, they realized that low intensity conflict offered the same opportunities for the use of information operations. Although, in the final analysis, the Chechens were judged masters of the information operations game.

The second aspect of air power that the author examines is the performance of both rotary-wing and fixed-wing aircraft in the campaign against the Chechens. The Russians extended rotary-wing tactics developed in Afghanistan (e.g., approaching targets at high speeds and low altitudes, making hard maneuvers on approach to the target, using electronic warfare assets) and used rotary wing aircraft in conjunction with fixed wing assets. However, the Russians had trouble coordinating rotary-wing aircraft with ground troops. Several factors contributed to this problem: units were often unable to collect or receive accurate and timely reconnaissance information; ground commanders were often unwilling to share their plans with pilots (instead, only providing them with specific instructions); and forward air controllers became favorite targets of the Chechens. Ultimately, Russian rotary-wing assets were of limited value in the conflict.

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[2] General Boyd, in an article that appeared in *Foreign Affairs*, noted that "a reliance on air power alone—the strike option—in this type of terrain with these types of targets has never held any real promise of conflict resolution."

Fixed-wing aircraft, because of their durability, emerged as the preferred means of air support in the campaign against the Chechens. However, for fixed-wing aircraft to perform effectively in the low intensity conflict, the aircraft had to be durable, capable of flying at low altitudes, capable of flying at low speeds, and capable of flying in all weather conditions.

THE BATTLE OF GROZNY: DEADLY CLASSROOM FOR URBAN CONFLICT

Thomas, T.L.
"The Battle of Grozny: Deadly Classroom for Urban Conflict"
Parameters
Summer 1999
Pages 87-102.

Timothy Thomas, a retired US Army lieutenant colonel and analyst at the Foreign Military Studies Office, provides the reader with a brief overview of lessons learned by the Russians in urban combat operations against the Chechens in the mid-1990s. While the bulk of the article focuses on lessons learned, Thomas also contemplates the implications and consequences of these lessons for future military operations in urban terrain.

Thomas identifies five lessons learned in the Russians' first campaign against the Chechen forces in Grozny.

- *Know your opponent and his turf.* Thomas relates how the Russians failed to understand either Chechen culture or the terrain on which operations would be conducted. They failed to consider not only the deep-seated hatred that a century of Russian domination instilled in the Chechens, but also cultural considerations such as *adat* (a revenge-based code of justice) and the nature of Chechen tribal relationships. Furthermore, the Russians failed to gain adequate situational awareness and understanding. For example, Russians typically had 1:100,000 scale maps when 1:25,000 (or better) scale maps were more appropriate. These failures enabled the Chechens to maximize both popular support and the terrain.
- *Don't assume—Prepare, prepare, prepare*. The Russians made several questionable assumptions in preparations for war against the Chechens. Among these assumptions were misreading the Chechen will, their own ability to plan and execute complex operations, and the readiness of the Russian units sent to Chechnya.
- *Choose the right weapons*. The confined and multi-tiered nature of urban terrain made some weapons and technologies preferable. The Chechens preferred rocket-propelled grenades (used as both direct and indirect fire support), cellular phones, commercial scanner systems, television signals, and the internet. The Russians preferred Kalashnikov assault rifles, grenade launchers, and flame-throwers, which flushed people and snipers out of buildings at significant distances and was as effective as 152 mm artillery. Both sides made heavy use of snipers to slow troop movements, force troops to take alternative routes, and demoralize their opponent.
- *Adapt tactics to the situation.* Fighting in the urban environment caused both sides to explore and exploit innovative tactics. The Chechens preferred a

"defenseless defense" in which they could maintain mobility at the expense of developing and defending strong points. Other Chechen tactics included blending in with the civilian population when possible, "hugging" Russian units, and boobytrapping or mining chokepoints. The Russians became methodical about taking the city, building by building, and block by block, and adopted the use of combined arms teams (e.g., a combination of infantry, mechanized, and armored units) to conduct operations.

- *Anticipate and resolve communications problems*. Establishing and maintaining communications was the Russians' most significant technical problem. Communication broke down at platoon, company, and battalion levels. This was complicated by the Russian's initial decision to transmit unscrambled messages, which enabled the Chechens to monitor and influence Russian message traffic. Furthermore, Russian soldiers carrying radios (with tell tale antennae) became prime targets for Chechen snipers. Russian after action reports recommended the acquisition of lightweight communications equipment, using cell phones and trunk-adaptable radios, and developing a common-use battery.

Additional lessons included the utility of non-lethal weapons, the psychological strain of urban operations, and that no two urban operations are alike.

GROZNY 2000: URBAN COMBAT LESSONS LEARNED

Thomas, T.L.
"Grozny 2000: Urban Combat Lessons Learned"
Military Review
July-August 2000
Pages 50-58.

This article looks at the different approach Russian forces took in attacking Grozny in January 2000 versus their 1995 attack. The changes in Russian tactics were as follows.

- *Improved political support from Moscow*. The apartment building bombings in Moscow generated popular support for the war. Moscow gave the military a force 2 to 3 times larger than the one used in 1995. President Yeltsin also promised the military he would abandon frequent cease-fires that so irritated the military in the first Chechen conflict.
- *More cautious advance on the city.* Instead of moving armor columns directly into the city, the Russians cautiously advanced to Grozny's outskirts. They then infiltrated several hundred snipers into the city to attrit Chechen forces and provide intelligence as to enemy location and movements.
- *Improved use of fire support.* For the first time the Russians decentralized their fire support system. They provided artillery support directly to smaller units, allowing for more responsive and effective support. Artillery hit Chechen forces at a distance, thus reducing Russian losses.
- *Improved communications security.* The Russians made much greater use of encrypting radio equipment.
- *Winning the propaganda war*. In 1995 the Russians lost the propaganda war by default. This time they made every effort to control the media and ensure that Moscow's view dominated public opinion.
- *Improved PSYOPS.* Russian forces waged an active campaign to encourage civilians to leave the city and erode support for the Chechen fighters. The Russians also planted false information about escape routes out of the city. When Chechen forces attempted to use these routes, minefields, and ambushes awaited.

Some problems still remained for Russian forces. Friction between Interior Ministry troops and Defense Ministry troops continued. Chechen human intelligence often proved more valuable then Russian signals intelligence. Russian forces still did not possess a reliable identification friend or foe system.

THE CHALLENGE OF CIVIL-MILITARY OPERATIONS

Tuozzolo, J.J.
"The Challenge of Civil-Military Operations"
Joint Forces Quarterly
Summer 1997
Pages 54-58.

In "The Challenge of Civil-Military Operations," author John Tuozzolo, a colonel in the US Army Reserve, examines the military's role in supporting two specific aspects of the Dayton peace accords (which ended the hostilities in Bosnia-Herzegovina in December of 1995): the creation of a "viable" central government and a functioning legal system. Initially, the roles of civilian and military agencies were separate and distinct. However, to overcome the political and social challenges of war-torn Bosnia-Herzegovina, the military had to cooperate and work with civilian agencies in unexpected ways.

Tuozzolo notes that despite a desire to limit the military to specific responsibilities detailed in the peace accords (separating and disarming the warring parties and enabling freedom of movement by civilians and non-governmental agencies), the actual conditions resulted in the military supporting civilians and civilian agencies in unexpected ways. Specifically, military civil affairs professionals assisted in the reconstitution of the legal system, the registration of voters, and producing and distributing educational material. While none of these missions were beyond the ability of uniformed civil affairs professionals, they were beyond the anticipated missions of IFOR. Despite the unexpected nature of the mission creep, a robust civil affairs capability enabled IFOR to perform its mission and enabled civilian NGOs to fulfill their missions.

CONCRETE COMBAT

Valceanu, J.
"Concrete Combat"
Soldiers
June 1999
Pages 41-46.

In this article, author Staff Sergeant John Valceanu describes the activities at the Shurgart-Gordon MOUT complex at Fort Polk, Louisiana. The facility is named for two soldiers posthumously awarded the Medal of Honor for their actions in Mogadishu. Units rotating through the Joint Readiness Training Center utilizes the complex.

The Center brings maximum realism to MOUT training. The $70 million dollar complex covers seven square kilometers and has 29 buildings. Some buildings are two to three stories tall and all contain appropriate furniture. Most rooms in the buildings are equipped with infrared cameras and microphones that allow observers to monitor what happens. Live-fire exercises can be conducted in some buildings up to platoon-level. Force-on-force exercises usually involve battalion- or brigade-size units against the resident OPFOR, the paratroopers of the Fort Polk-based 1st Battalion, 509th Infantry. A company of paratroopers, with an intimate knowledge of the terrain, can often repulse a battalion-size attacking force. Unit training also forces visitors to contend with "civilians." These role-players, provided by the JRTC, assume the roles of the mayor, the local Red Cross, and regular citizens. Units being trained must attempt to minimize civilian casualties, while countering intelligence efforts or hostile actions by the civilians.

The final piece of the training package is the after-action review. Using footage and sound bites captured by the facility's sophisticated audiovisual equipment, soldiers have a chance to watch and hear themselves. Discussing the actions with observer-controllers can help the troops learn what worked and what did not.

THE RESURRECTION OF RUSSIAN ARMOR: SURPRISES FROM SIBERIA

Warford, J.
"The Resurrection of Russian Armor: Surprises from Siberia"
Armor
September-October 1998
Pages 30-33.

"The Resurrection of Russian Armor" will be of great interest to those concerned about recent developments in main battle tanks and armored personnel carriers.

Both the Israelis and the Russians have fielded heavy armored personnel carriers (APCs) to overcome the demonstrated inadequacies of lightly armored APCs. The Russian BMP-2 proved vulnerable to Chechen rocket propelled grenades (RPG), and the Israeli's US built M113 fell short of the challenge in the 1982 war in Lebanon against the same weapons. The Russian BTR-T heavy APC and the Israeli Achzarit heavy assault carrier are both based on the old Soviet T-54 or T-55 cast steel hull with turret and main gun removed. Engine horsepower has increased, as has troop carrying capacity. The Achzarit is reputed to have advanced composite armor as well. The BTR-T will likely be fitted with Kontakt-5 explosive reactive armor.

The article also recounts the main battle tank (MBT) arms race between the US Army and the Soviet Army. In 1988, the Future Soviet Tank FST-2 had a low-profile, unmanned turret with a 135 mm main gun, two- or three-man crew, layered composite armor capable of defeating NATO antitank weapons, and counter-optics capable of blinding NATO optical systems. The FST-2 prompted the US Army to adopt depleted uranium armor in its MBT. The FST-3 may have evolved into the Russian Black Eagle MBT, announced in 1997, although its specifications have not been made public. Some claims have been made that the main gun is 152 mm, but more common claims are that it will have a 135 mm to 140 mm main gun. The hull is welded, not cast, and will employ the Russian version of Chobham composite armor as well as the additional protection of Kontakt-5 reactive armor. A 1500 hp gas-turbine engine powers the tank. References were made to electro-magnetic armor that will revolutionize tank design.

MARINE TECHNOLOGY DOLLARS TO FOCUS ON URBAN COMBAT

Willingham, S.
"Marine Technology Dollars to Focus on Urban Combat"
National Defense
December 1999
Pages 20-21.

This article reviews the efforts of the Marine Corps to improve equipment stocks for urban combat. The author attended the Modern Day Marine Military Exposition that showcased various advanced equipment. The Exposition functions to allow industry to both interact with military personnel and check out what competing defense suppliers are working on. Several marines attending the show thought the equipment was too technical to be practical for combat or available in the near future. Another marine stated that marines take pride in being able to still get the job done will hand-me-down, less advanced equipment.

The Marine Corps Systems Command deals with research and acquisition of everything from combat boots to computers. One of the primary goals in the technology program is to move experimental systems out of the lab and get them to marines in the field quickly. For this reason the Corps is increasingly purchasing commercial off-the-shelf products. The Marine Corps is also looking to outsource some of its various functions. This would free up personnel for more combat-related assignments. Outsourcing would also fit in conveniently with plans to create a lighter more lethal force.

U.S. UNPREPARED FOR URBAN WARFARE, ANALYSTS CAUTION

Willingham, S.
"U.S. Unprepared for Urban Warfare, Analysts Caution"
National Defense
April 2000
Page 33.

This article surveys the views expressed at a Special Operations and Low Intensity Conflict symposium in Arlington, Virginia, sponsored by the National Defense Industrial Association. The general view of the urban warfare experts present at the symposium was that the US military currently lacks the skills to operate successfully in cities. The Russian experience in Grozny was held up as an example of what happens when military forces cannot fight in the urban environment. The Russians had to destroy the city to save it from the insurgents. Attendees commented that the Russians seemed to have forgotten the lessons of Stalingrad. They expressed little confidence that the US military could do better.

The view was that the US lack of capability derived from several areas. One was a lack of joint training. Current facilities are not sufficient to permit joint exercises, they need to replicate cities in the Third World. Communications will also prove difficult in cities. The increased mental strain of MOUT would also be a factor; due to short engagement ranges and surprise. One attendee stated that the morale of the troops might give out before material resources did.

Some suggested that the United States needs to dominate the urban environment like it does currently in the air. One official from the Office of the Secretary of Defense stated that the long-standing goal of taking the entire city is no longer valid. Instead, urban fighters need to focus on the portions of the city that will achieve desired results.

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Infantry	www.benning.army.mil/dot/magazine/magazine.htm
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13. ABSTRACT (Maximum 200 words)

The third volume of this three–volume report is a collection of topics that range from interoperability between Services to historical looks at experimentation and warfighting on urban terrain. Appendix G describes the series of joint experiments, the purpose of which was to facilitate U.S. Army and U.S. Marine interoperability and collaborative planning. Appendix H provides a look at experimentation between the two World Wars and derives lessons for the U.S. military today. Appendix I highlights the JAWP's thinking about experimentation beyond the theoretical, describing what constitutes joint warfighting experimentation. Appendix J describes the challenges DoD faces in transformation and joint experimentation, and how to measure progress towards DoD goals during a time where the environment is oriented toward success, quick returns, and zero defects. Appendix K is a thoughtful picture of the lessons reaped from the tragedies of urban operations in twentieth-century warfare, and how the U.S. military must face psychological and political barriers that seem to make it virtually impossible to fight directly for the control of cities in the twenty-first century. Finally, Appendix L is a bibliography that surveys classic and recent articles on military operations in urban terrain.

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